PROSPECTIVE STUDY IN PREDICTING PREGNANCY OUTCOME USING YOLK SAC PARAMETERS IN FIRST TRIMESTER

A PROSPECTIVE OBSERVATIONAL STUDY

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MADRAS MEDICAL COLLEGE, CHENNAI.

MAY - 2019

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled **"PROSPECTIVE STUDY IN PREDICTING PREGNANCY OUTCOME USING YOLK SAC PARAMETERS IN FIRST TRIMESTER "** is the bonafide original work done by **Dr. SELVI . R** under the guidance of **Dr.SHOBHA,MD., DGO,** Professor of Obstetrics and Gynecology, Institute of Obstetrics and Gynecology, Madras Medical College, Chennai in partial fulfillment of the requirements for MS Obstetrics and Gynecology branch II examination of the Tamil Nadu Dr.MGR Medical university to be held in MAY 2019. The period of post graduate study and training from MAY 2017 to MAY 2019**.**

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DECLARATION

I solemnly declare that this dissertation **"Prospective study in predicting pregnancy outcome using yolk sac parameters in first trimester"** was prepared by me at Institute of Obstetrics and Gynecology, Egmore, Madras medical college,Chennai, under the guidance and supervision of **Dr.SHOBHA, MD., DGO,** Professor of Obstetrics and Gynaecology, Institute of Obstetrics and Gynecology, Madras Medical College, Chennai.

This dissertation is submitted to **The Tamil Nadu Dr.M.G.R. Medical University, Chennai** in partial fulfillment of the University regulations for the award of the degree of **M.S. (Obstetrics and Gynaecology).**

Place: Chennai
Date:

(Dr. SELVI. R)

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INTRODUCTION

Yolk sac is the first ultrasonographically visible extra embryonic structure within the gestational sac. Between Human embryo and mother, yolk sac is the primary route of exchange before circulation of placenta is established. Yolk sac reaches its highest level of functional activity in 4^{th} to 7^{th} week of embryonic development. It serves as a hematopoietic, secretory, metabolic, immunogenic, excretory function.

Primary Yolk sac forms at approximately twenty four days of menstrual age. When the extraembryonic coelom forms, primary yolk sac is pinched off and the secondary yolk sac is formed at 27 to 28 days of menstrual age. This as mentioned above becomes the first embryonic structure to be visualized in gestational sac sonographically.

Gross changes in its morphology, indicate significant dysfunction of this transport system between maternal and fetal parts. This also may indicate impending embryonic demise. In the early stage of pregnancy, evaluation of embryo and gestational sac by ultrasound is very important.

Accurate differentiation between normal pregnancy and loss of pregnancy in early gestation is the most important clinical challenge..

The estimated implanted pregnancies resulting in spontaneous abortion during 1^{st} trimester is around thirty to forty percent. Critical landmark to identify a true gestational sac is the Yolk sac. Ultrasound shows Yolk sac as a round

structure with anechoic center bordered by a regular well defined echogenic rim. Yolk sac diameter is usually 2- 5 mm and it increases in size till 10^{th} week.

In Early pregnancy, threatened and spontaneous abortions is the most common complication. As per some studies, enlarged or small yolk sac predicts poor pregnancy outcome. Whereas other studies, they conclude normal outcome. Thus, the purpose of this study is to evaluate the yolk sac size and correlate with outcome of pregnancy.

AIMS AND OBJECTIVES

To study and evaluate the inner diameter and the shape of yolk sac in first trimester using transabdominal ultrasonography and to correlate it with pregnancy outcome.

MATERIALS AND METHODS

This study is a prospective one. The study is conducted in Institute of Obstetrics and Gynecology, Egmore, Chennai. Pregnant patients attending the antenatal outpatient clinic are chosen for study using the criteria detailed below. Total of hundred patients are chosen between the study period November 2017 to October 2018.

STUDY DESIGN:

Prospective observational study

ETHICS:

The Institutional Ethical committee clearance obtained

STUDY POPULATION:

The study will be conducted in pregnant patients presenting to antenatal clinic in Madras Medical College, Chennai.

SAMPLE SIZE : 100

DATA COLLECTION

Details of demographic and obstetric data will be collected from enrolled patients.

The details of the parameter like Age, Parity, Gestational age will be recorded from the patients enrolled in the study after getting informed consent from the patients.

INCLUSION CRITERIA:

1. Uncomplicated Singleton pregnancy belonging to 8 to 12 weeks.

EXCLUSION CRITERIA:

1. Patients with medical illness like diabetes, anaemia, hyperthyroidism,Chronic hypertension causing abnormal pregnancy outcome.
2. Patients with structural anomalies of uterus and cervix
3. If patients are not agreeing to come for follow up
4. Mullerian anomaly cases

METHODOLOGY :

Once selected using above criteria, they are divided into two groups. One group of pregnant patients between 8 to 10 weeks of pregnancy.Another group between 10 to 12 weeks of pregnancy. They undergo Trans abdominal Ultrasound by the same sonographer to find out the

- Yolk sac size where it is from inner to inner diameter
- Yolk sac shape
- Rim and center echogenicity
- number
- If calcification present

Normal yolk sac are the ones with diameter of two to five millimeter and which has a circular shape with no degenerations

Abnormal yolk sac are the ones with diameter less than two mm or bigger than five millimeter and not having circular shape and with degeneration and with not equal embryos

Transabdominally diagnosis of blighted ovum is done by, gestational sac greater than 20 mm without a yolk sac or 25mm without an embryo. The yolk sac that is imaged is the embryologic secondary yolk sac. The primary yolk sac is pinched off by four weeks gestation and the secondary yolk sac is the one that is visualized till about 11 weeks of gestation. The yolk sac should be routinely

identified before the embryo is visualized because the yolk sac can be seen when the prochondral plate of the evolving embryo is getting formed.

Patients are followed up till 20 weeks. If pregnancy continued beyond 20 weeks it is considered as normal pregnancy outcome. If it ended with abortion, then it is considered abnormal pregnancy outcome. Observation and statistical analysis will be made comparing yolk sac diameter with the outcome of pregnancy at 20 weeks.

The readings of yolk sac diameter is marked for each patient. Patients presenting at 8- 10 weeks are evaluated to find out the rate of abortion. In the same way patients presenting at 10- 12 weeks of pregnancy are also tabulated.

Based on the analysis, the results will be published and chart prepared to match the outcome of each patient followed up till twenty weeks to find out the outcome of each pregnancy.

REVIEW OF LITERATURE

Relevant Embryology:

Fertilization is a complex one. Using Molecular tools, the spermatozoa passes between follicular cells and through the zona pellucida. Then it passes into the oocyte cytoplasm. Both nuclei fuse together and mixing of maternal and paternal chromosomes results in formation of zygote.

After fertilization, the zygote which is a diploid cell with 46 chromosomes undergoes cleavage, and zygote cells produced by this division are now called as *blastomeres.* As there is continuous division of blastomeres, Morula which resembles solid mulberry like ball of cells is produced.[1]

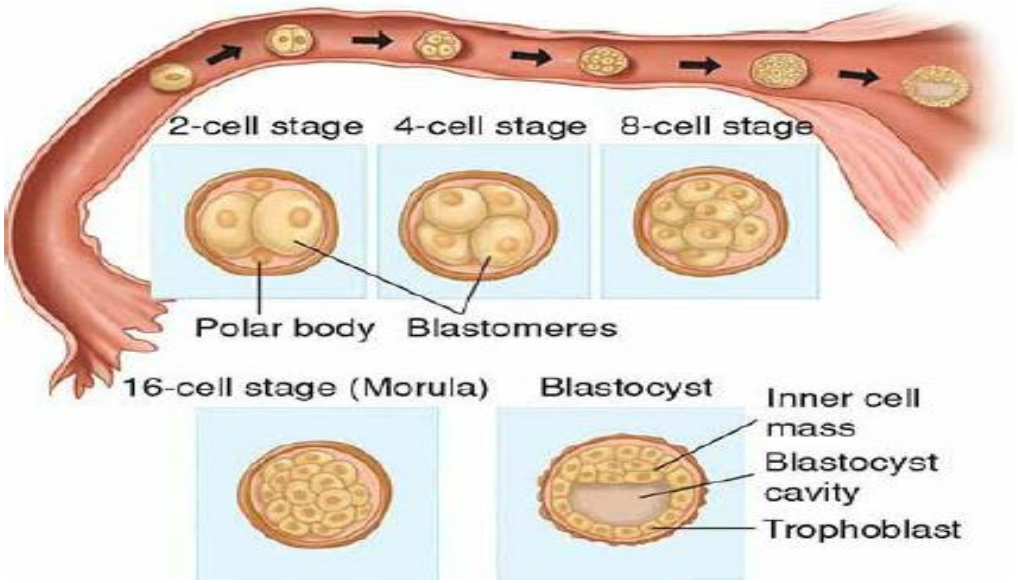
The morula then enters the cavity of uterus, usually three days after fertilization. Accumulation of fluid gradually between the Morula cells leads to formation of the early *blastocyst*.As early as 4 to 5 days after fertilization, the 58-cell blastula differentiates into five embryo-producing cells called as *inner cell mass.* The remaining 53 outer cells, called the *trophectoderm,* are destined to form *trophoblasts.*

The inner mass of cells differentiate to become embryoblasts and polarize at one end. They form gap junctions that facilitates cellular communication. This polarization gives rise to a cavity, which is now called blastocoel.

Inner cell mass will give rise to embryo proper, the amnion, yolk sac and allantois. Six or seven days after fertilization, blastocyst implants into the wall of

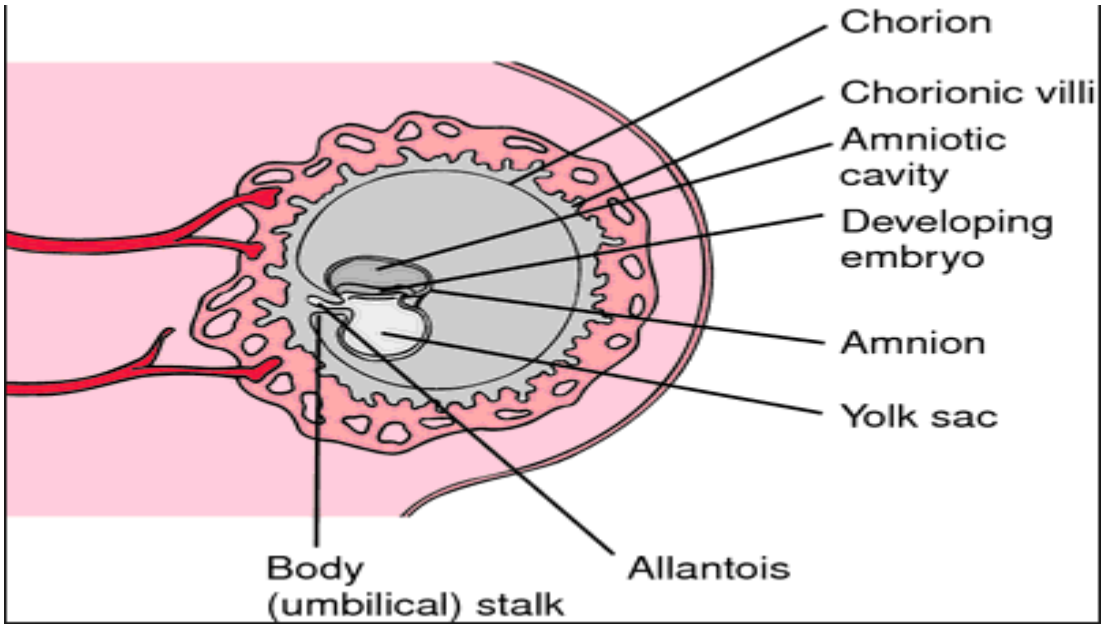
uterus. This occurs in 3 phases namely, apposition which is initial contact of the blastocyst to the uterine wall, secondly the adhesion which is increasing physical contact between blastocyst and deciduas, thirdly invasion which is penetration along with invasion of syncytiotrophoblast and cytotrophoblasts into the decidua, myometrium, and uterine vasculature.[2]

The primordial germ cell arises from the wall of the yolk sac during the 2nd week of gestation.



Embryology of yolk sac :

Human yolk sac was considered as a vestigial organ, a remnant of evolution. Since it does not have any yolk, this misthinking was thought.. In the last ten years, however the yolk sac is now proving to have an active and critical role during organ formation.



Since there is improvement in medical technology, this helps in making proper diagnostic procedures available during the first trimester of pregnancy. Mantoni and Pederson were the first to describe usg visualization of the secondary human yolk sac way back in 1979.

Following which large number of clinical studies about the yolk sac were conducted. There is also Carnegie Collection which was described by O'Rahilly and Miiller. Just after implantation in day 7-12 of embryonic age, the distal part of the primary yolk sac is pinched off. This results in a comparatively smaller secondary yolk sac which is seen as a ventral protrusion of the primitive gut.[3]

FOLDING OF EMBRYO IN FORTH WEEK :

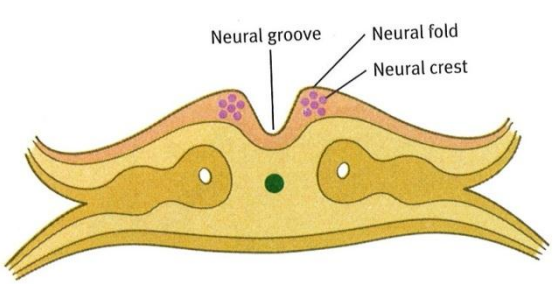
The folding takes place in about two direction. One is longitudinal which is also cephalo caudal and the other one is lateral which is also transverse. The Longitudinal folding occurs as a consequence of rapidly enlarging cranial end of the neural tube to form the brain. The lateral folding is a consequence of enlargement of somites.[4]

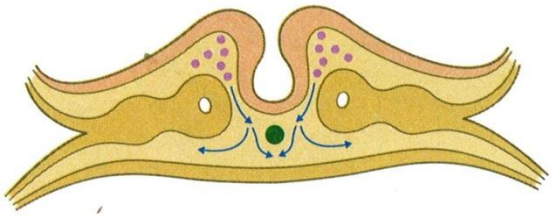
The longitudinal folding which occurs between the days 21 and 24 results in bending of embryo, so that the head and tail are brought close together. The endoderm forms the tube like structure with a initially wide communication with the yolk sac. This communication narrows as the longitudinal folding increases. The amniotic cavity pushes in at the cranial and caudal end of the embryonic disc. This results in increasing the degree of longitudinal folding at the head and tail folds. The amniotic cavity also pinches the connection of the yolk sac and the gut to form the narrowed communication of vitello intestinal duct. Later this duct gets lost.[5]

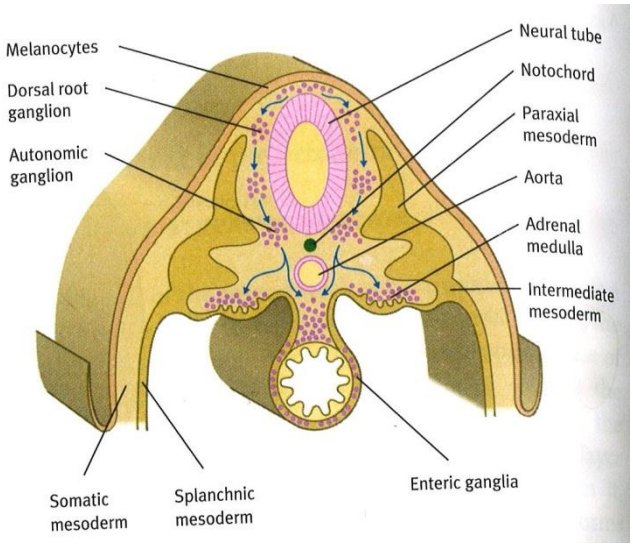
The yolk sac plays a important role in the early nutrition of embryo, but it is lost after the first month and the vestigial yolk sac lies freely in the chorionic cavity.

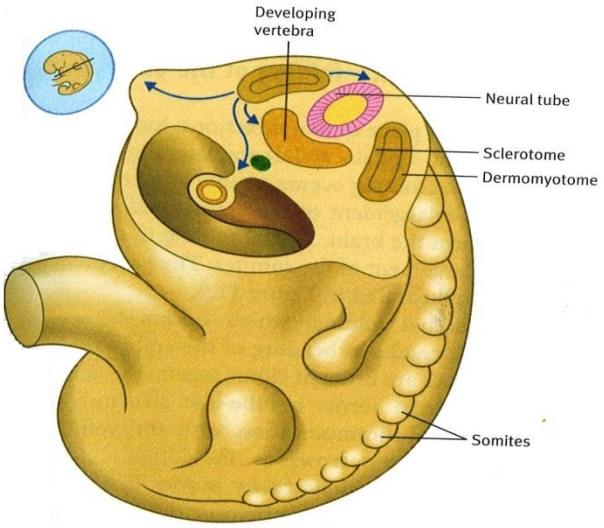
Progressive cavitation in meshwork of loose parenchymeresults in formation of surrounding exocoelomic cavity in day 13. The secondary yolk sac functions as the first haemopoietic organ of the embryo. In the wall of the yolk sac, there develops an extensive vascular system in day 16. This vascular system

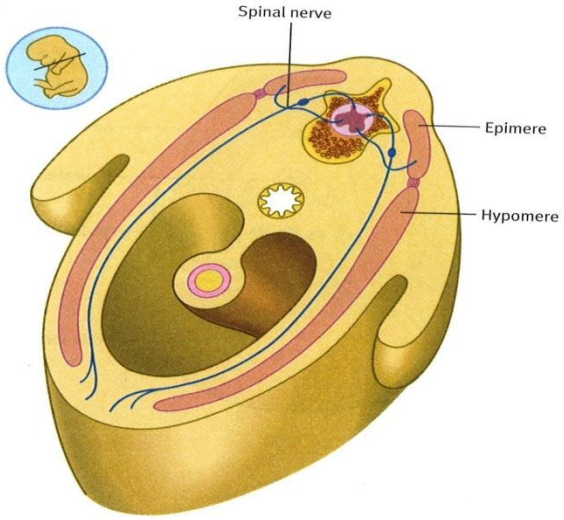
then connects to the embryonic circulation through the vitelline artery and vein. From day sixteen onwards, usually the gestation sac can be visualized by transvaginal ultrasound.



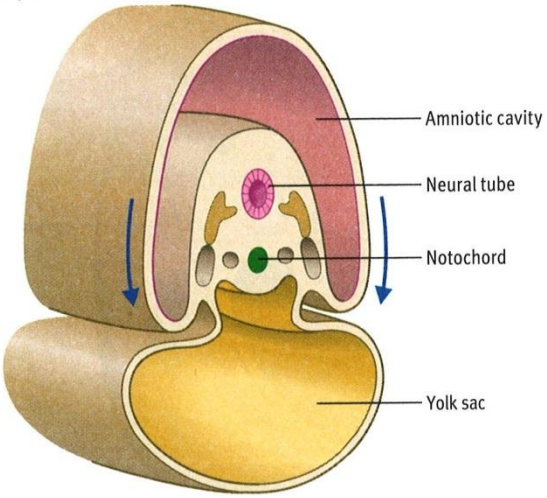








Day 18



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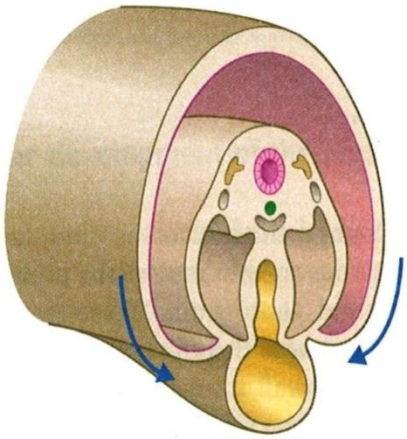
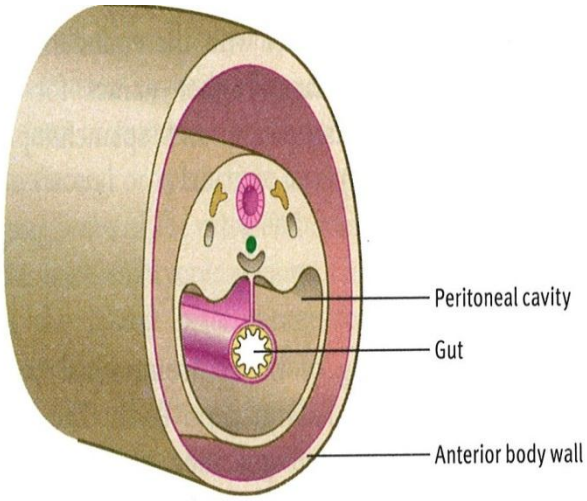
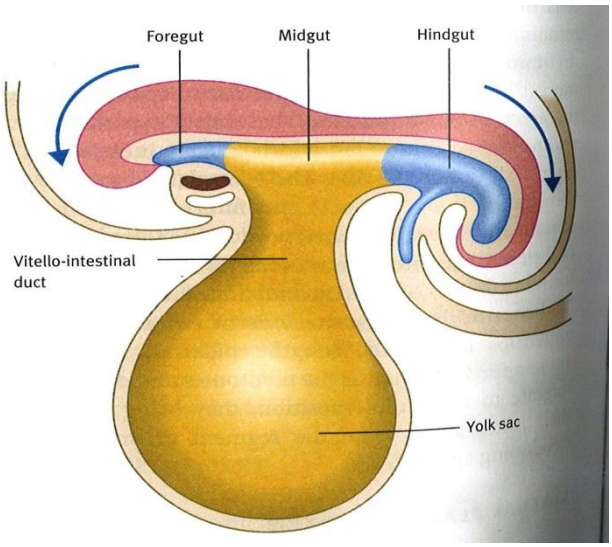


Day 24



Process of Longitudinal Folding by day 25 in a Saggital section of an embryo



After few days ,at about 5-6 weeks, the yolk sac is observed as a first ultrasound signal of embryonic development. The length of embryo is 3 mm at 5+3 weeks and this can be measured from that moment. Embryonic heartbeats are believed to start 3 days earlier would already be seen at that time. Three mm embryo will already be covered by the amniotic membrane.[6]

After a few days, because of the more curved shape of the embryo, the yolk sac is now more clearly seen between the amnion and chorion. The yolk sac stalk which contains the vitelline duct and vessels, now attaches to the stalk of the embryo, and this finally becomes included in the umbilical cord, leaving the yolk sac positioned in the exocelomic cavity.[7]

O'Rahilly and Miiller therefore introduced the more appropriate name of 'umbilical vesicle', but we shall continue with the traditional misnomer 'yolk sac'. The yolk sac size increases to about 5-7 mm in the 10th week, and during this period of development, the vitelline duct is visualized by ultrasound. Spontaneous regression of the yolk sac already starts at about 9 weeks, despite some increases in size thereafter, and by the end of the first trimester, the absorption of exocoelomic fluid occurs, so the amnion has fused with the chorion.

The yolk sac may be observed as a chalk spot on the chorionic plate of the placenta occasionally.

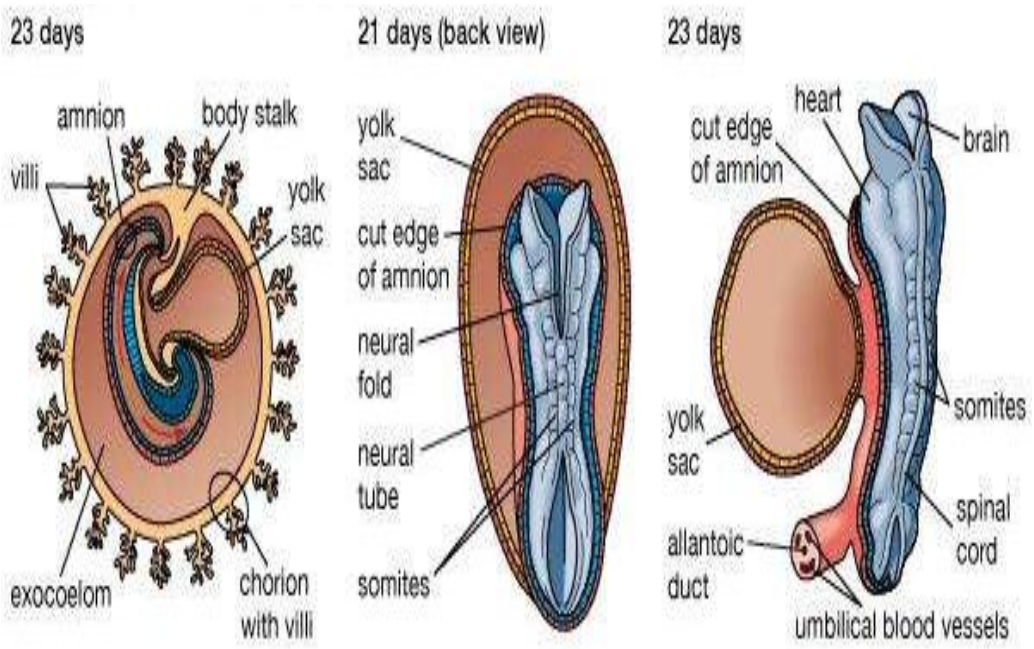
YOLK SAC (DEFINITIVE) :

The yolk sac which is definitive has two layers of membrane (extraembryonic). This will be lined by endoderm which is present on the inner part and the outer part will be lined with mesoderm. This is how it will look with its linings.[13]

When this structure appears like this with outer and inner layers lined with respective linings, then this is called as the splanchnopleure. This might be present in the allantois also.

The tissue that is in the endoderm now it will give the epithelial cells and the mesoderm which is present will generate the blood supply to and from this epithelium. In addition to this, the layer which is present on the outside that is the mesoderm, is the critical point of blood cell generation for the embryo.[14]

This structure in human beings usually not there before delivery itself . Although its remnants can be rarely seen after birth.This can be an abnormality which is called as Meckel's diverticulum. But other than this yolk sac remnants are usually not seen.[8]



Usually nutrients are absorbed from the yolk sac through capillary plexus which are complex and vitelline veins called as the vitelline circulation. This energy providing nutrients are given to the developing embryo. Diverticulum like structure that forms from the back part of yolk sac is called as the allantois. Tiny portion of yolk sac does get stuck inside the embryo that results in the forming of the digestive tube which is primitive. This will actually be made into a small structure in the embryo. This is called as the vitelling duct. Some people call it as a vesicle (Umbilical). [17]

Microscopy of yolk sac :

The microscopy of yolk sac depicts its function that it is going to perform in the foetal period. The secondary yolk sac which consists of flat mesothelial cells

with microvilli as external layer, vascularized mesenchyme as intermediate layer, and endodermal columnar cells with microvilli as internal layer.

The endodermal cells then forms canalicular system, which results in an architecture that looks like tissue of liver. As previously described, other than evidence for active and passive transport of nutrients and intense biosynthetic activity, the yolk sac clearly demonstrates an active haemopoiesis is demonstrated by large number of nucleated blood cells.[18]

Function of yolk sac :

Hertig work informs us that the contact between the two vascular systems is made between weeks five and seven. It is questionable as to whether the placental circulation is of any functional significance during the first trimester of pregnancy. The functional significance of the yolk sac is as follows

- absorption of nutrients from the exocelomic cavity both by means of active and passive transport
- cY-fetoprotein synthesis
- Increased concentration of folate and Vit B12 are found in exocoelomic fluid in 9-12-week pregnancies, which suggests an important role in the exchange from embryo to maternal serum.

DNA synthesis and cell proliferation are dependent on these nutrients. Experiments in animals have also given direct evidence of the role of the yolk sac in mediation of nutrition to embryo in the developmental period even preceding the formation of a functional chorioallantoic placenta.

Placenta formation :

Human placenta usually starts to begin with trophectoderm. The trophectoderm appears at the morula stage. This then gives rise to trophoblast cell layer which encircles the blastocyst. Till term, this layer of trophoblast plays an important role at fetal and maternal interface.

Differentiation of Trophoblast :

Eight days postfertilization, the trophoblast differentiates into an outer multinucleated syncytium which is called as Primitive syncytiotrophoblast, and inner layer of primitive mononuclear cells which is called as Cytotrophoblasts.

As soon as the implantation is complete the trophoblast then differentiates along two pathways, the villous and the extravilloustrophoblast. Chorionic villi arises from the villous trophoblast.

Extravillous trophoblasts is classified as interstitial trophoblasts and endovascular trophoblasts. The interstitial trophoblasts invades decidua and then they penetrate the myometrium resulting in the formation of placental bed giant cells. The endovascular trophoblasts on the other hand, penetrate the spiral artery lumens.

After gentle erosion between epithelial cells of the surface endometrium, invading trophoblasts burrow deeper. At 9 days of development, the blastocyst wall facing the uterine lumen is a single layer of flattened cells. By the 10th day, the blastocyst becomes totally encased within the endometrium .

The blastocyst wall opposite the uterine lumen is thicker and comprises two zones—the trophoblasts and the embryo-forming inner cell mass. As early as 7½ days postfertilization, the inner cell mass or embryonic disc differentiates into a thick plate of primitive ectoderm and an underlying layer of endoderm. Some small cells appear between the embryonic disc and the trophoblasts and enclose a space that will become the amnionic cavity.

Extraembryonic mesenchyme first appears as groups of isolated cells within the blastocyst cavity, and later this mesoderm completely lines the cavity. Spaces form and then fuse within the extraembryonic mesoderm to form the chorionic cavity which is extraembryonic coelom. The chorion is composed of trophoblasts and mesenchyme. Some mesenchymal cells usually condenses to form the bodystalk. This body stalk joins the embryo to the nutrient chorion and which later develops into the umbilical cord.

The body stalk usually recognized at an early stage at the caudal end of the embryonic disc.As the embryo grows, more maternal decidua basalis is then invaded by syncytiotrophoblast. Beginning at usually, twelve days after conception, the syncytiotrophoblast is permeated by a system of intercommunicating channels called trophoblastic lacunae.

After invasion of superficial decidual capillary walls, the lacunae which are present become filled with maternal blood. The decidual reaction intensifies in the surrounding stroma at this time. This is usually characterized by decidual stromal cell enlargement and storage of glycogen.

In early pregnancy, the villi are distributed over the entire periphery of the chorionic membrane. In the first trimester, placental growth is more rapid than of the fetus. Approximately at seventeen weeks gestation, placental and fetal weights are approximately equal. By term, placental weight is approximately one sixth of fetal weight.

As pregnancy advances, the yolk sac becomes smaller and its pedicle relatively longer. By the middle of the third month, the expanding amnion obliterates the extraembryonic coelom, fuses with the chorion laeve, and covers the bulging placental disc and the lateral surface of the body stalk. The latter is then called the umbilical cord or the funis.

During the birth of a child, 2 arteries and 1 vein are seen in the umbilical cord normally. The umbilical vein on the right side usually disappears early during growth of the baby, leaving only the left vein.

Uses of ultrasound in early pregnancy :

Ultrasound has become an integral part of obstetrician armamentarium and is considered as an extension of an examining finger. An ultrasound scanner has transducers that is the probes, a screen that is used to view the image and the technical data and a control panel. The ultrasound waves are the result of inverse piezoelectric effect.

The transducer which is used to transmit and receive ultrasound waves consist of several piezoelectric crystals. The amount of beam reflected back is proportionate to the difference in the acoustic densities in the tissues that are present at the interface.

In case of calcified tissues like the bones, stones and in case of air, the entire beam may be reflected and an echo rich image is obtained. In case of homogenous fluids like blood, urine and amniotic fludid the entire amount of waves are not reflected and only transmitted so that an echo-free image is obtained.

The velocity of sound waves is a constant at 1540 m/s and always determined by the wave length and the frequency. Hertz is the international unit of frequency.

Ultrasound is the reliable tool to evaluate early pregnancy and its complications. To get a ultrasound image, the pressure wave has to interact with the tissue that is going to be studied. Then the pressure wave will return to the piezoelectric crystal to get converted from mechanical energy to electrical energy. Reflection, Scatter, Absorption are the three main principal interactions that a ultrasound pressure wave does with a tissue.

The reflection part occurs at interfaces between tissues having different characteristics. If the difference in acoustic impedance is more, then greater the degree of reflection. Scatter takes place when ultrasound waves interact with a tissue that has dimensions similar to or smaller than the ultrasound wavelength.

This occurs typically with small structures called blood cells or parenchyma. So if we increase the frequency of ultrasound pressure wave, then the intensity of scatter increases. Absorption is the conversion of mechanical to heat or molecular energy.

The transducer in an ultrasound has piezoelectric crystal which will vibrate and generate ultrasound beam. Modern era transducers tend to be a broadband one with frequencies that are selectable. They come in different sizes and shapes based on the frequencies intended to be used.

The frequency of ultrasound waves are greater than 20,000 Hz and are not audible to human ear. The frequency of obstetric ultrasound varies from 2 to 15 MHz. in a higher frequency transducer the penetration of the beam is poor and they will have a higher spatial resolution, that is they will differentiate two closely located spots with higher diagnostic accuracy.

So, these high frequency probes can be used to study superficial structures, the transvaginal probes use the frequency ranging from 5 to 15 MHz . The low frequency probes are used to study the organ at a depth because they can penetrate more. The abdominal probes uses the frequency of order of 2 to 6.5 MHz.In obstetric Trans abdominal approach is widely used. We use transvaginal techniques on special situations in obstetrics like

1. First trimester for fetal morphology and to detect the complications of early pregnancy.
2. Assessment of cervix length and incompetence features.
3. Special situations like placenta previa and vasa previa.
4. To delineate the cranial anatomy in a case of deeply engaged head.

Fan shaped image is the resultant image. Previously used assembly types such as linear transducers, mechanical arrays and circumferential array are currently outdated due to technical limitations.

The lesions and the structure that are echo free are referred as anechoic, sonolucent and echolucent and fluidic. The solid echo rich structures or lesions are referred as hyperechoic, echogenic and echo bright. The lesions and structures with few echoes are called as echo poor, echopenic (or) hypo echoic.

A-Mode Studies

Most primitive ultrasound imaging studies and are no longer used now.

B-Mode Studies

It is widely used now. The reflections are arranged along the two axes in the region of interest, it is a real time one. The conventional ultrasound scan we use today is a real time grey scale B mode study that is also called as 2D Study.

3D study is an addition of a third dimension to a 2D image with the help of a special transducer and a computed software. 4D ultrasound study is a real time 3D.

M- Mode Studies

It is a motion mode in a B-mode studies and is used for visualizing and for measuring the fetal cardiac activity and also for study of cardiac valves and the myocardium.

Doppler

It is used to indicate the blood flow information. Doppler effect takes into account the fact the moving target alters the returning frequency of the waves. A newer form of flow imaging is the power doppler .It displays the flow information as a amplitude of scatter of the ultrasound waves in contrast to the frequency shift employed in conventional Doppler.

Safety of Ultrasound and patient considerations

The evidence available says that there is no deleterious biological effect to the mother or the fetus. For a pulsed Doppler between 11 to 14 weeks, the thermal index should be low and the exposure should be as low as possible as upto 10 minutes.

ALARA principle

ALARA principle to be followed that is to get a quality images with frequencies, power and duration as low as reasonable achievable. The women undergoing examination should be given due respect and care and the examination must be painless and must adhere to safety principles. The use of frusemide to fill the urinary bladder must not be used as the drug because it doesn't have any safety approval in early pregnany. Routine filling of the bladder should also be discouraged as it may introduce infections. 200 – 300 ml of bladder volume is optimal for visualization. For vaginal probes air drying is adequate for destroying human immuno deficiency virus but may be inadequate for some microbes. A condom may be used for a vaginal probe.

The criteria for abnormal pregnancy include , embryo 5mm or more in crown rump length which is pulseless, gestational sac larger than 20mm which doesnot have a yolk sac. The other poor prognostic factors include sub optimal growth of embryo, bradycardia of embryo, unusually large or small gestational sac, abnormal yolk sac, diffuse or focally echoic amniotic cavity, hemorrhagic chorion. Now colour Doppler evaluation is increasingly useful to evaluate pregnancy suspected to have a poor outcome.

Noted person Sir Ian Donald was the one to first describe the use of ultrasound and the full bladder technique in 1962. He explained the identification of fetal pole. He confirmed the fetal pole can be visualized by 6^{th} week of amenorrhoea and with reasonable certainity by the 7^{th} week. Robinson measured

the CRL in mm and estimated the gestational age. Today with the advanced technology gestation sac can be visualized by vaginal probes by 4.5 weeks of gestation. The corresponding level of serum beta HCG is 1500 – 2000 mIU/ml and 3600 mIU/ml for the visualization of the sac by vaginal and abdominal methods respectively. The ultrasound can be done to confirm a pregnancy, location, viability and also dating. It can also exclude ectopic or molar pregnancy. Ultrasound is very much dependent on the operator and their technique. For a B mode ultrasound image to be produced, the beam of ultrasound should be swept across the proposed field of view. To produce an image, about 200 ultrasound beams would be used.

An intrauterine gestational sac is visualized with transvaginal ultrasound by 5 weeks, and an embryo with cardiac activity is visualized by 6 weeks. The embryo has to be visible transvaginally once the mean sac diameter has reached 25 mm, or else the gestation is called *anembryonic*.

When the embryo length reaches 5 mm, Cardiac motion is usually visible with transvaginal imaging. In embryos of size less than seven mm without cardiac activity, further examination may be needed subsequently to determine the viability. The first ten weeks of the first trimester is roughly called as early pregnancy.

Radiographic features in Antenatal ultrasound:

The earliest sign in a established pregnancy is persistence of a vascularized Corpus Luteum. It appears as a hypo echoic / iso echoic / hyper echoic area in the active ovary. The following represents the features noted in ultrasound from the time the gestation establishes. These findings tell us that gradually we will be able to find the yolk sac.

At **0-4.3 weeks:** There will be no ultrasound findings

At **4.3-5.0 weeks**

Signs that are noted in ultrasound are the gestational sac which is tiny, DDSS and the IDSS. These features are explained below.

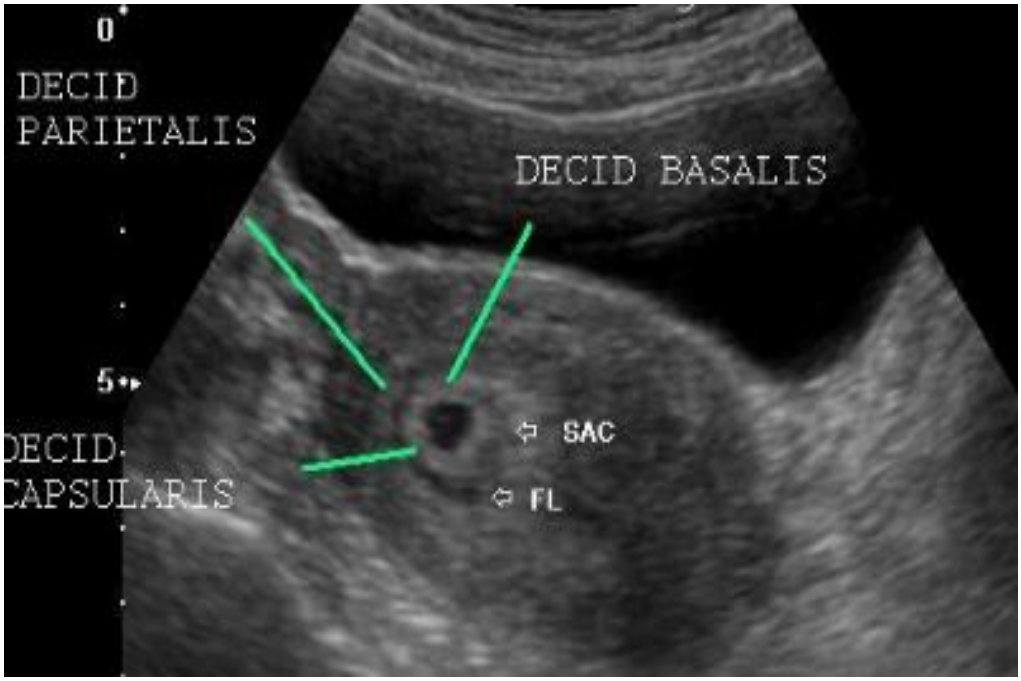
The double decidual sac sign (DDSS) is a feature that is useful in ultrasound done in early pregnancy. This is to confirm an early intrauterine pregnancy even when the yolk sac or embryo is still not visualized or seen. This consists of the decidua parietalis which is lining the uterine cavity and decidua capsularis which lines the gestational sac. These two are seen as two concentric rings which surrounds an anechoic gestational sac. These two where they adhere, that layer is called the decidua basalis. This decidua basalisis the site of placental formation in future.

If a double decidual sac sign is noted, approximately 53% of intrauterine pregnancies, then this is highly suggestive that the intrauterine fluid collection, which is noted , is an intrauterine pregnancy. This may also be absent in many

intrauterine pregnancies, however, and its absence does not define a pseudogestational sac.

When a definite intrauterine pregnancy not able to be confirmed on ultrasound, then it is better to repeat ultrasound later along with serial quantitative beta HCGs are required, until either an intrauterine pregnancy is thus established, an ectopic pregnancy is visualized, or beta-HCG returns to zero which will imply miscarriage.

Double decidualsign :



At 5.1-5.5 weeks

We should be able to find the gestational sac on ultrasound by this time. The characteristics of the sac can also be assessed on ultrasound at 5 to 5 and half weeks.

At5.5- 6 weeks

We can see the yolk sac now and approximately the sac of gestation will be around six millimeter now and we can see the following sign. This is explained below in detail.

Double bleb sign

A **double bleb sign** is a ultrasound feature that occurs when there is visualization of a gestational sac which in turn will contain a yolk sac and amniotic sac. These two sac together will give an appearance of two small bubbles. Embryonic disc will be located between the two bubbles. This is an important finding noted in case of an intrauterine pregnancy.

This finding of double bleb sign will differentiate a pregnancy from a pseudogestational sac or decidual cast cyst. This double bleb sign should not be confused with the double decidual sac sign.

More than 6 weeks:

On trans vaginal ultrasound, we can see the pole of the fetus that can be around one to two millmetre, we can also see the heart rate of the fetus will be around 100-115 bpm. If we try to measure the sac of gestation, usually it will be about ten mm in diameter.

The fetal pole is defined as a thickening noted on the margin of the yolk sac of a fetus during pregnancy. The fetal pole is usually identified at six weeks with transvaginal scan. In transabdominal ultrasound, this should be visible at six and a half weeks. But it is also quite normal for the fetal pole to be not visible even up and until about nine weeks.

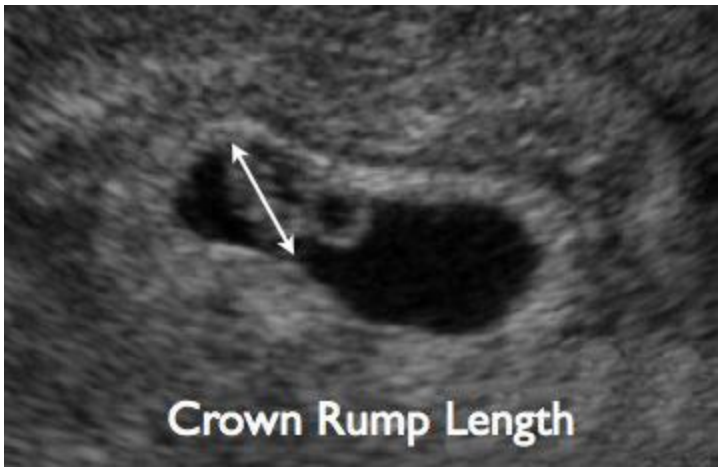
Fetal pole :

At **6.5 weeks** :

Crown rump length should be around 5 mm.

The fetal crown-rump length which is also denoted as CRL, is defined as the longest length of the fetus excluding the limbs and yolk sac. It is defined as the measurement between the top of the head to the area above where the legs begin. The fetalcrown-rump length is measured through ultrasound. This crown rump length is measured usually up to the fourteenth week of the pregnancy.

Crown rump length ;

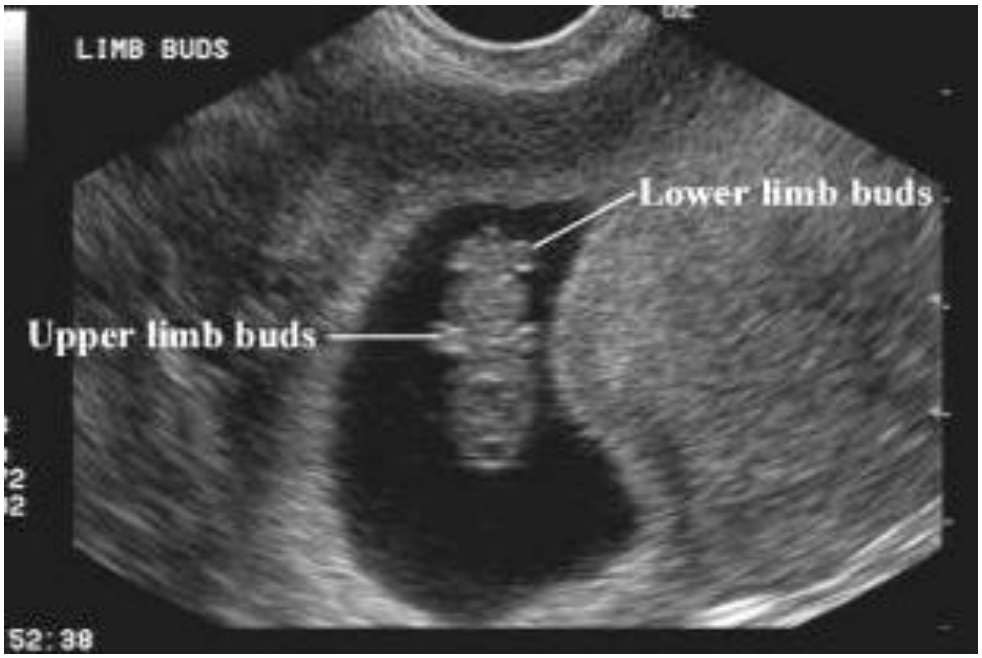


At **7-8 weeks** :

The Crown rump length should be between 11-16 mm. At this time , we should be able to identify the cephalad and caudal poles of the fetus in the ultrasound.

At **8-9 weeks**

The Crown rump length should be between 17-23 mm, appearance of limb buds may be seen, head can be noted as a separate structure from the body.



At 9-10 weeks

The Crown rump length should be between 23-32 mm. The heart rate of fetus at that time will be around 170-180 beats per minute. We can appreciate the movement of the fetus. We can see a circular structure which will have less echoes, that is the rhombencephalon of the brain of the developing fetus. Nuchal translucency will be seen.

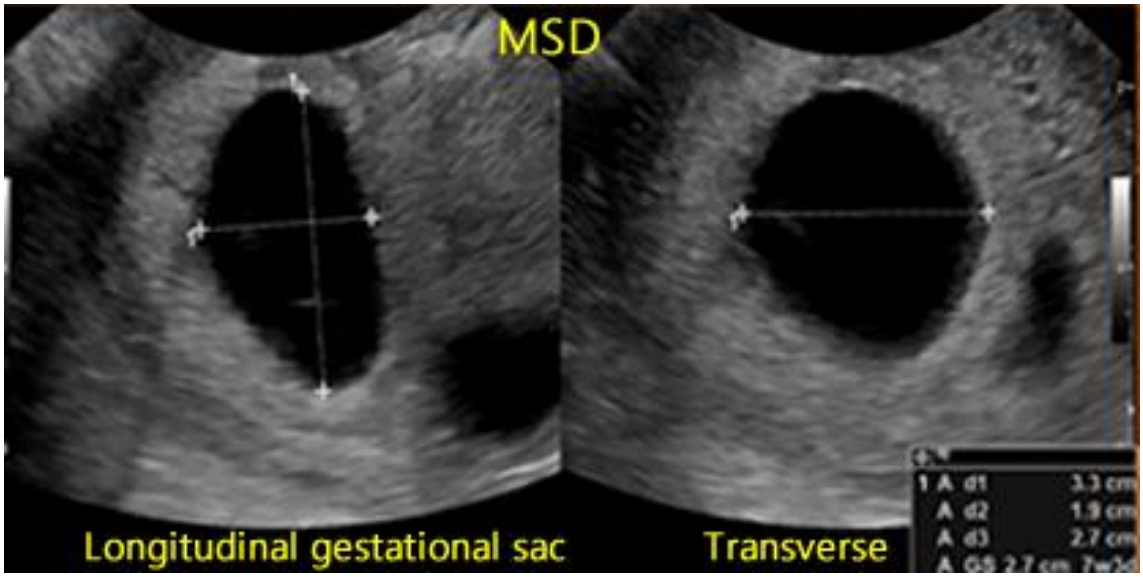
Findings in Transvaginal ultrasound scanning:

In Transvaginal ultrasound scan, the following findings are noted :

IDSS : intradecidual sac sign is the early sign noted on a Transvaginal scan

- When the 25 mm MSD measurement , an embryo must be visible.
- We should be able to appreciate the heart activity of the developing fetus as this above mentioned MSD measurement.

We should see an embryo at less than or equal to fourteen days after a scan with a gestational sac without a yolk sac. Similarly we should see embryo at 11 days more than or equal to with a gestational sac with a yolk sac.



This above picture depicts the view in ultrasound of the gestational sac visualized at this time. We can see the longitudinal and transverse views.

Importance of yolk sac in early pregnancy :

We can see the yolk sac as the first one to be seen inside the sac of gestation. This yolk sac will be seen as circular and regular structure which is present extra amniotically. This will be seen usually when the sac of gestation reaches a diameter of eight to ten. The value of the yolk sac in the first part of pregnancy will be ranging from two to five millimeter. We can observe that most cases without a yolk sac or which has calcifications which suggestive of

degeneration or which has more than five millimeter or less than two millimeter have high chance of miscarriage. We should see the yolk sac in case of a normal pregnancy at about five to twelve weeks of pregnancy. If the yolk sac is above nine millimeter then we should suspect a disorder of growth in the fetus.

If we have a sac of gestation that is having a yolk sac diameter equal or larger than five mm that is recorded on an ultrasound in the early stages of pregnancy, the these cases have to be followed up very closely as they are having a very high (as close to three times) risk for spontaneous miscarriage that is noted in the first trimester. The above mentioned factor is not dependent on the other risks that the mother might be harboring which are like increased weight or BMI, increasing maternal age, PCOD of the mother, having habits like smoking, or having chronic diseases like diabetes mellitus.

The absence of a yolk sac or finding a smaller than calculated gestational age yolk sac diameter are indicative of pregnancies that may result in spontaneous abortion. Pregnancies that are detected with a ultrasound finding of a very large yolk sac are generally associated with poor outcome.

Guidelines for Early pregnancy loss Diagnosis :

Sonographically,

1. Crown rump length more than equal to 7mm and no heart beat.
2. MSD more than or equal to 25mm and no embryo.

3. Initial ultrasound showing gestational sac with yolk sac and after 11 days no embryo with heartbeat is seen.
4. Initial ultrasound scan showing gestational sac without a yolk sac and after more than two weeks no embryo with heartbeat is seen.

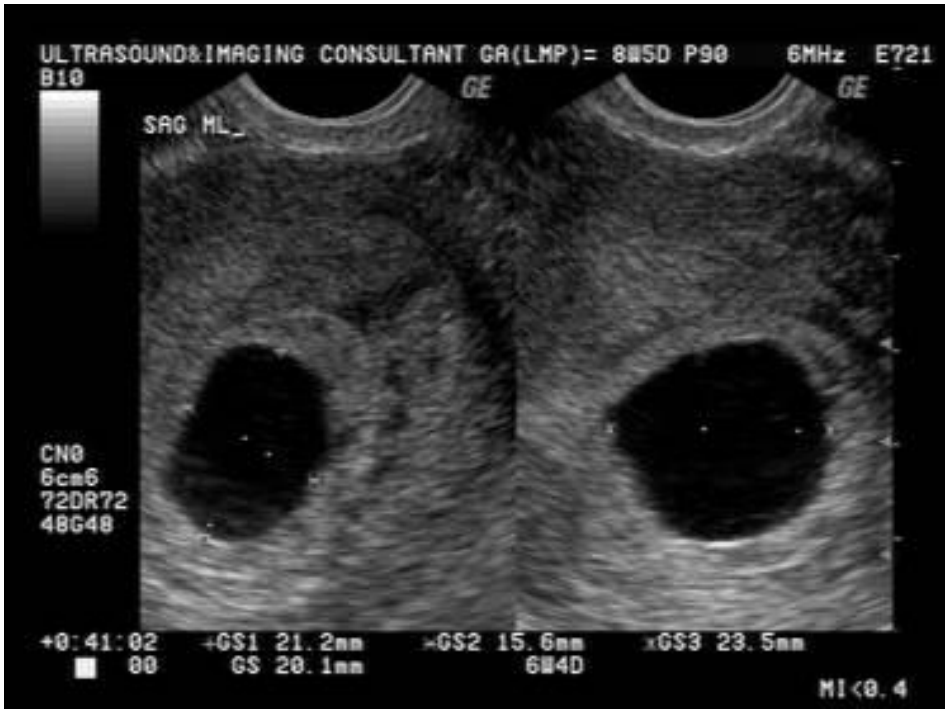
In addition to the above parameters, other softer parameters that may portend early failure of pregnancy also exists. Yolk sac diameters that are measured inner to inner ring for each gestational week. The diameters of yolk sac more than or equal to 5mm in pregnancies less than ten weeks gestation are suspicious for failure. The fetal heart rate in 1st trimester increases from 110 to 130 bpm at six weeks gestation to 160 to 170 bpm at eight weeks. A slower heart rate is not favourable, this is more pronounced if heart rate is less than 85 bpm/ Subchorionic hematoma which is explained as blood collection in between the chorion and uterine wall also portends threatened abortion.

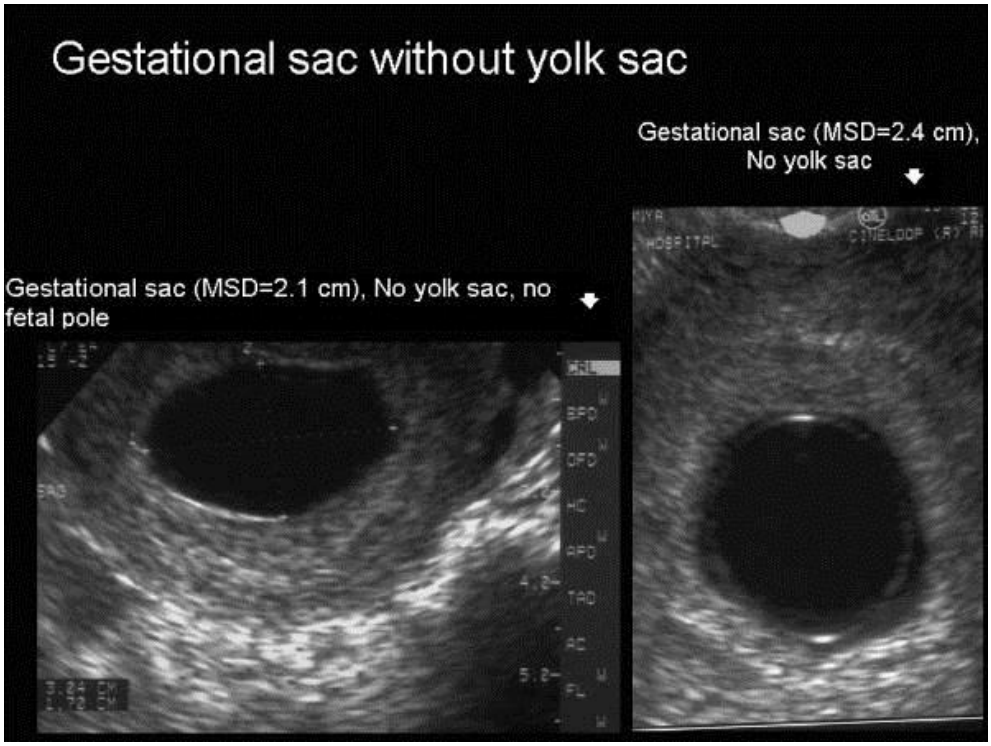
Blighting :

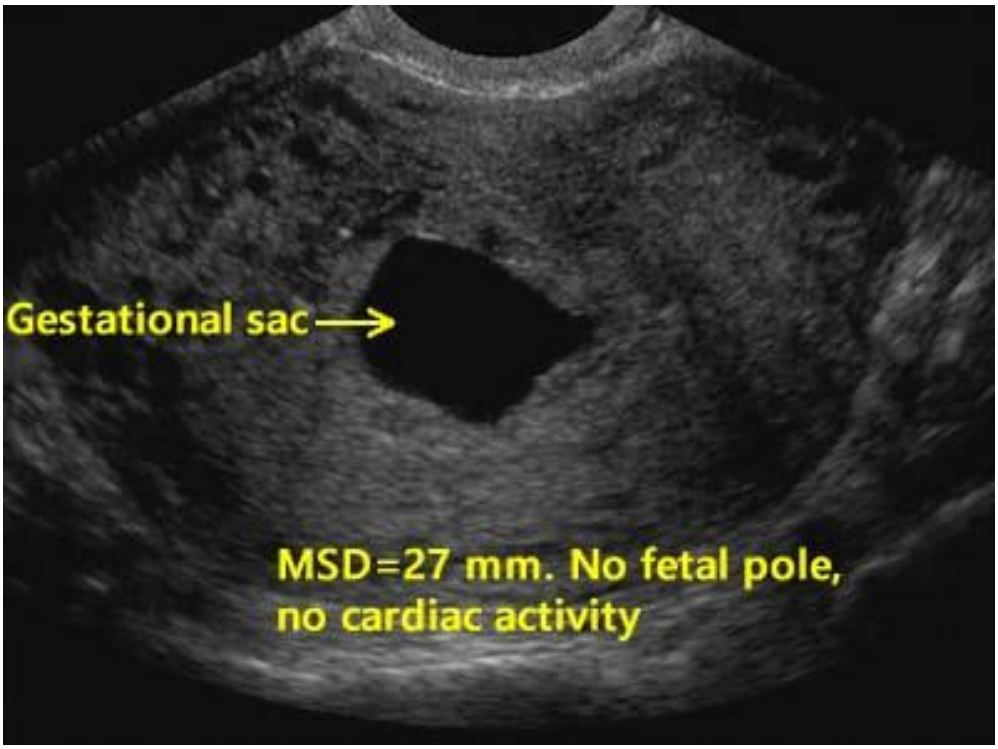
The features described below suggest ultrasonic evidence of anembryonic gestation ;

a. Intradecidual position of gestational sac.
b. Absent yolk sac with mean sac diameter more than 13mm on transvaginal scan or 20mm in transabdominal scanning.
c. The embryo is absent in a sac more than 16mm MSD by vaginal scanning or more than 25mm on transabdominal scanning.

d. Thin decidual reaction less than 2mm, weak decidual echo amplitude, lower uterine position or irregular contour of gestational sac.







Very rarely, a pregnancy that was considered blighted may show evidence of growth, if re examined one week later. This happens very rarely with the availability of high end machines today. But, since there is no harm in giving the patient one week time, it is better to wait and redo the ultrasound before telling them the diagnosis. The fate of these cases would be spontaneous abortion of minor type. If material is good and fresh, chromosomal analysis can be done. When the maternal age is more, the incidence of chromosomal abnormality is in the level of 82.5 %, but if she is younger then it is 57.2%.

ABORTION :

The definition of above can be considered as pregnancy termination which can happen by itself (spontaneous) or which can be induced , before the period of viability that is now accepted as twenty weeks of gestation or a birth weight of 500g. The rate of spontaneous abortion is roughly about 10- 15 %. There is a strict act to curb the indiscriminate abortion which is called as Medical Termination of pregnancy act in India in 1971.

Spontaneous abortion :

Spontaneous abortion passes through three stages which are threatened, incomplete and complete abortion. Approximately 80 % of spontaneous abortion occur in first 12 weeks of gestation. In first trimester losses, the demise of fetus or embryo always precedes spontaneous abortion. This is accompanied by hemorrhage in decidua basalis. This is followed by adjacent tissue necrosis leading to uterine contractions and expulsion. If it is anembryonic abortion then there will be no identifiable embryonic elements. Embryonic miscarriages will display abnormality of embryo, yolk sac or placenta. In later pregnancy losses, the fetus usually does not die before expulsion.

Fetal factors:

Around half of miscarriages are euploid abortions, that is which has normal chromosomes. Another half will have chromosomal abnormality. As the

gestational age advances, the rates of abortion and chromosomal abnormality comes down. In Chromosomal abnormalities, maternal gametogenesis errors cause 95% and paternal errors cause 5%. The most common chromosomal abnormality noted is trisomy present in 60 % ,monosomy in up to 13%, Triploidy in the rest.

Maternal factors:

Maternal causes play a role when there is a normal chromosomal abortion. Various medical disorders, developmental abnormalities, environmental factors play a role. When compared to aneuploid ones, euploid pregnancies abort later. Infections and medical disorders also play a role.

Threatened abortion :

The first stage is when there is an intact pregnancy but there is a risk to its continuation. The main symptom would be the bleeding which will usually precede the pain.

If patient presents with predominantly pain, then we have to exclude ectopic pregnancy. The bleeding amount would be variable but will not be heavy. But the pain would be mild discomfort. If bleeding persists beyond few days, then speculum can be used to rule out local issues like erosion or a rare cervical malignancy.

Incomplete abortion :

The next stage is incomplete abortion. This presents with bleeding. Some studies have indicated failure rates of 15 % using expectant management.

Complete abortion :

Complete expulsion of pregnancy may occur at times and cervical os will subsequently close. These patients will have heavy bleeding, cramping and tissue passage is typical. Patients should be encouraged to bring in the passed tissue in which complete gestation should be discerned from clots or decidual cast which is layer of endometrium in the shape of cavity of uterus.

If we are not able to see a expelled complete gestational sac, then transvaginal ultrsasound should be done to see for threatened abortion or ectopic pregnancy. So complete abortion cannot be diagnosed for sure unless we have true products of conception seen, sonographic confirmation of a intrauterine pregnancy previously and now has a empty cavity.

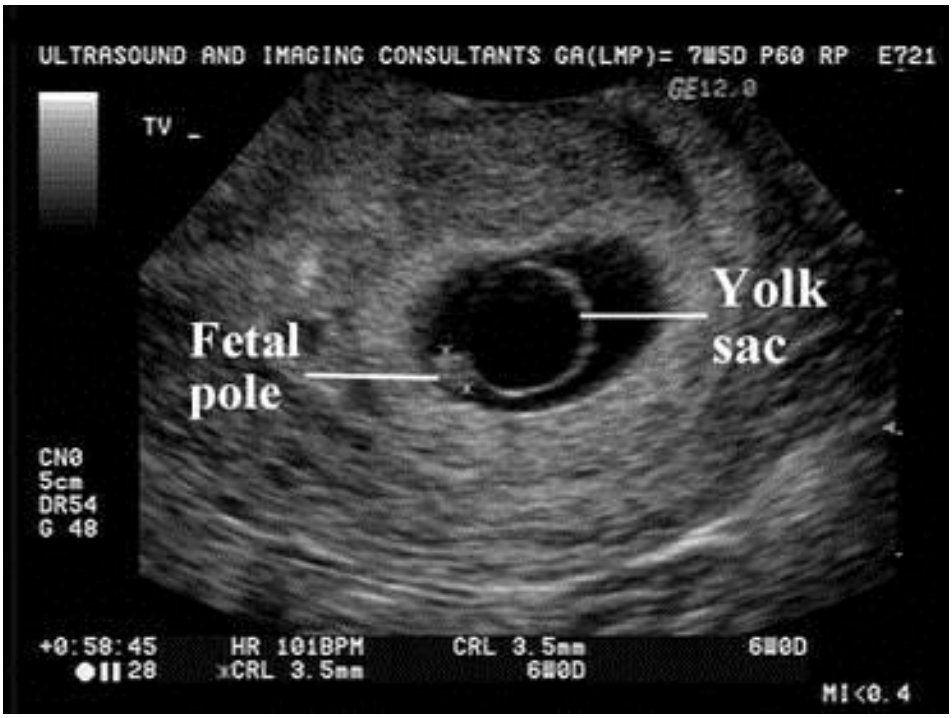
If still not clear, serial serum beta HCG levels can give clarity. If there is a complete abortion, the levels fall quickly.

Missed abortion :

This denotes presence of dead products of conception, retained for days or weeks in the uterus with a closed cervical os. Transvaginal scan is the main tool in diagnosis.

ULTRASOUND PICTURE SHOWING AN ABNORMALLY INCREASED DIAMETER OF YOLK SAC

This picture depicts the ultrasound image of a patient who went in for abortion. The yolk sac measured greater than 2 SD.



OBSERVATION

The study undertaken here is an prospective observational study conducted at Institute of Obstetrics and Gynecology, Madras Medical college, Egmore.

Total number of patient analyzed: 100

The first trimester pregnant patients were made into two groups, one group presenting at weeks 8 to 10 and another group presenting at weeks 10- 12. These patients underwent transabdominal ultrasound to find out the yolk sac diameter and morphology of yolk sac. The findings are documented.

The patients are then followed up till twenty weeks and the outcome of the pregnancy is recorded. The findings are then statistically analyzed to find out whether yolk sac diameter and morphology have any bearing on the outcome of pregnancy at 20 weeks. The findings are displayed as graph or bar diagram to arrive at a conclusion.

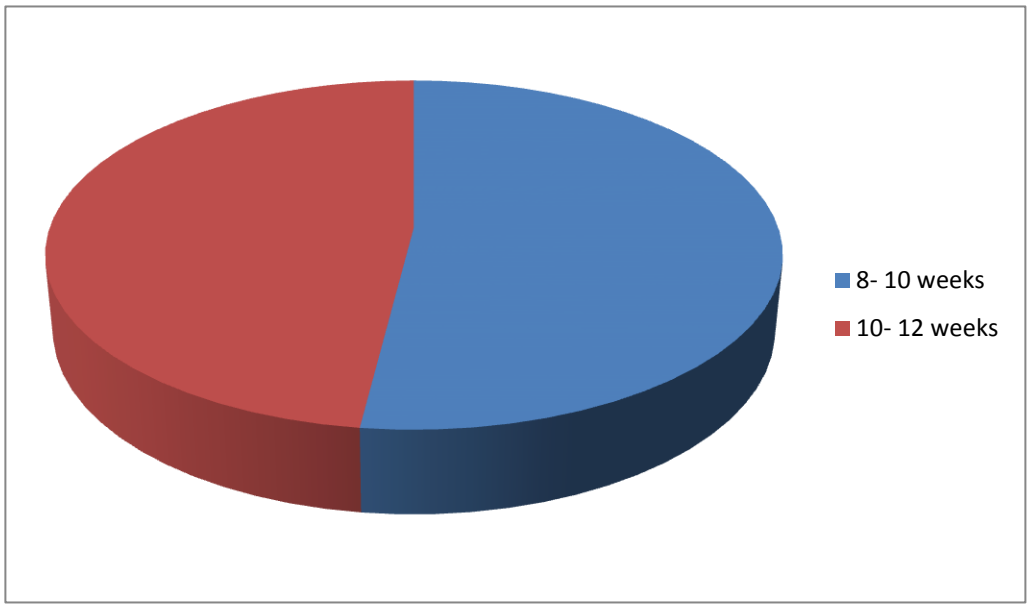
Comparison of both groups with respect to outcome is recorded followed by age, gravida, para, consanguineous marriage. Finally the yolk sac diameter and its correlation is recorded.

1. Comparison of 8- 10 weeks and 10- 12 weeks :

In this prospective observational study, totally 100 patients were taken. In the first group, that is 8- 10 weeks group, totally 52 patients were studied. In this group, the normal outcome was seen in eighteen patients, Missed abortion was seen in 28 patients, Blighted ovum was seen in six patients.

In the second group, forty eight patients were studied. The gross outcome in this group was, normal outcome in sixteen patients, 28 patients had missed abortion, blighted ovum was noted in four patients.

So, overall in this study 34 patients had normal outcome, 56 patients had missed abortion, blighted ovum was noted in ten patients.

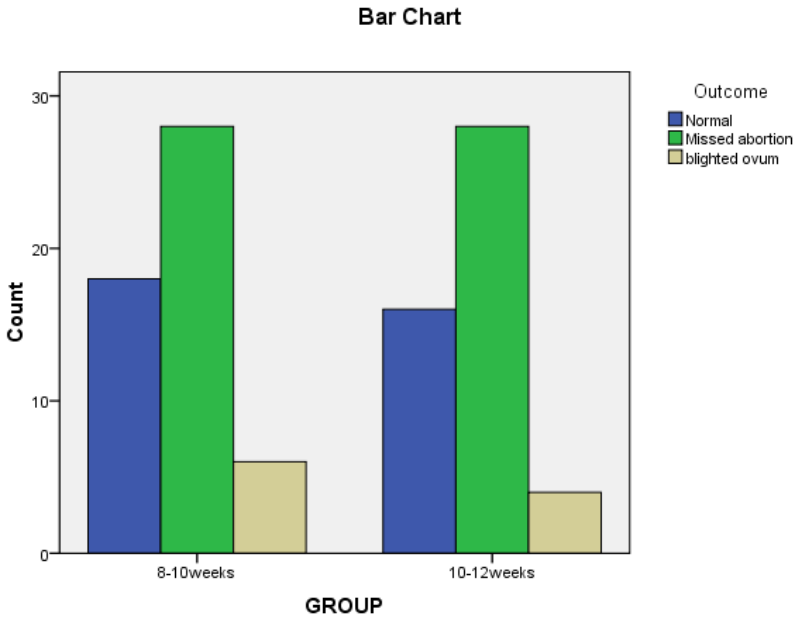


		Outcome			
		Normal	Missed abortion	blighted ovum	Total
8-10weeks	Count	18	28	6	52
	% within Outcome	52.9%	50.0%	60.0%	52.0%
	% of Total	18.0%	28.0%	6.0%	52.0%
10-12weeks	Count	16	28	4	48
	% within Outcome	47.1%	50.0%	40.0%	48.0%
	% of Total	16.0%	28.0%	4.0%	48.0%
Total	Count	34	56	10	100
	% within Outcome	100.0%	100.0%	100.0%	100.0%
	% of Total	34.0%	56.0%	10.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.358[a]	2	.836
Likelihood Ratio	.360	2	.835
Linear-by-Linear Association	.024	1	.877
N of Valid Cases	100		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.80.



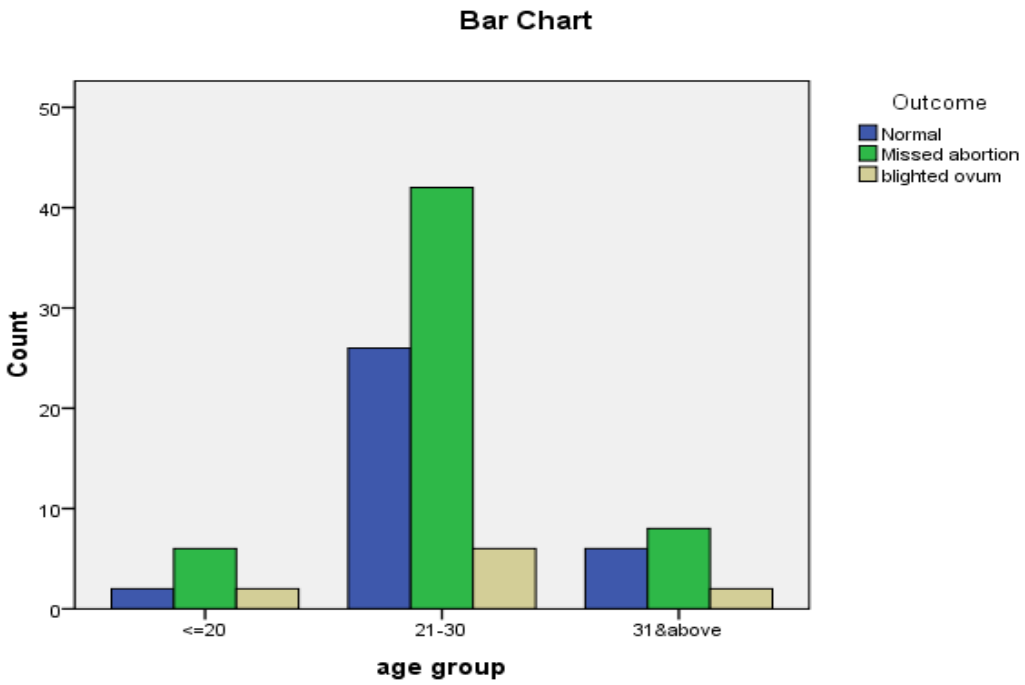
1. **Age distribution of Pregnant patients and its correlation with various factors in the study group:-**

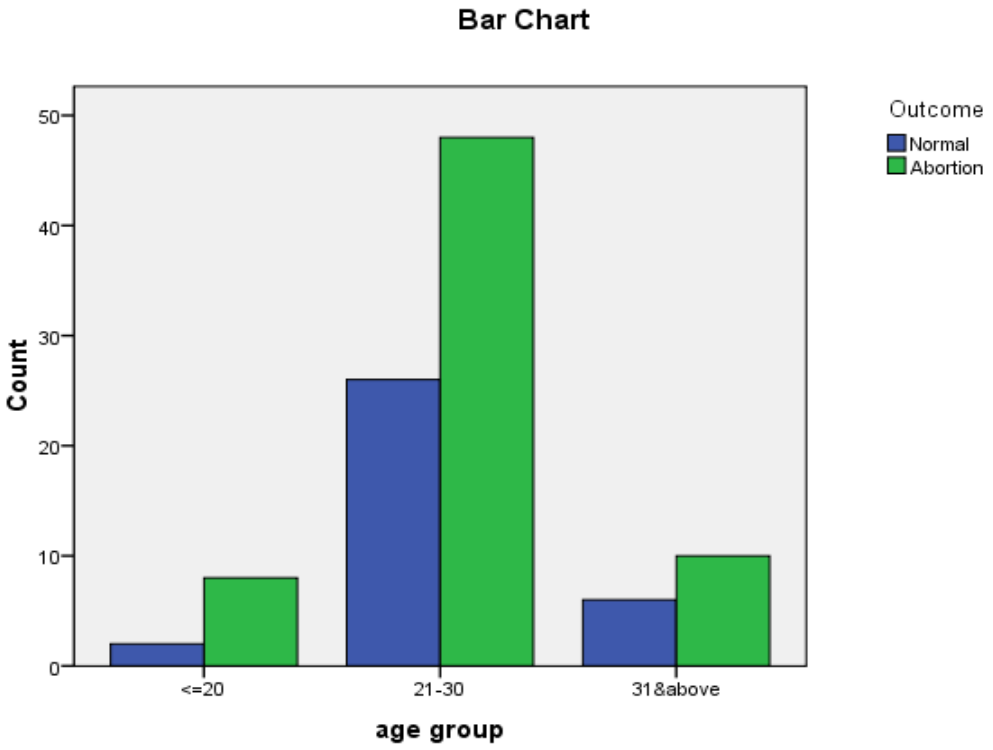
Age distribution in this study is accordingly, below 20 years of age is around ten patients. Majority of the patients in this study constituted between 21- 30 years, which is about 74. The next highest was in the above 31 years of age, which is about 16.

When the age is tabulated against the outcome, in the group below 20 years of age, 2 patients had normal outcome, 6 had missed abortion, 2 patients had blighted ovum. In the age group of 21 to 30 years, 26 patients had normal outcome, 42 had missed abortion, 6 patients had blighted ovum. In the age group of above 31 years, 6 patients had normal outcome, 8 had missed abortion, 2 patients had blighted ovum.

	N	Mean	Std. Deviation	Std. Error
Normal	34	28.18	3.639	.624
Missed abortion	56	27.04	4.156	.555
blighted ovum	10	24.20	4.780	1.511
Total	100	27.14	4.163	.416

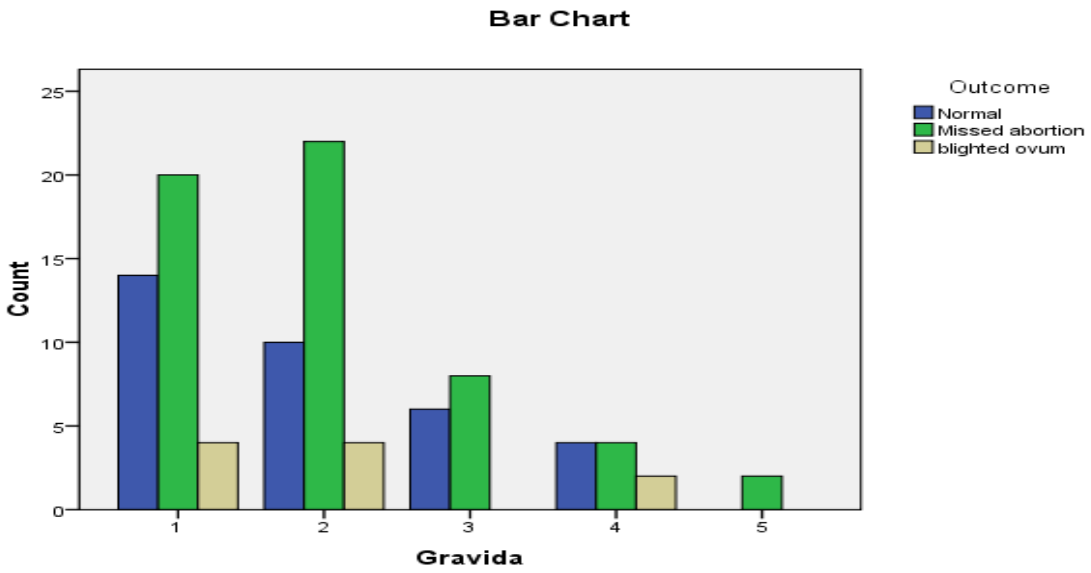
			Outcome		
			Normal	Abortion	Total
Age	<=20	Count	2	8	10
		% within Outcome	5.9%	12.1%	10.0%
		% of Total	2.0%	8.0%	10.0%
	21-30	Count	26	48	74
		% within Outcome	76.5%	72.7%	74.0%
		% of Total	26.0%	48.0%	74.0%
	31&above	Count	6	10	16
		% within Outcome	17.6%	15.2%	16.0%
		% of Total	6.0%	10.0%	16.0%
	Total	Count	34	66	100
		% within Outcome	100.0%	100.0%	100.0%
		% of Total	34.0%	66.0%	100.0%


Bar Chart
Outcome
Normal
Missed abortion
blighted ovum
Count
50
40
30
20
10
0
<=20
21-30
31&above
age group


Bar Chart
Outcome
Normal
Abortion
Count
50
40
30
20
10
0
<=20
21-30
31&above
age group

2. Correlation of gravid and para with outcome of this study :

As explained by this bar chart below, when we tabulate the outcomes such as normal outcome, missed abortion, blighted ovum. This bar chart explains that in this study missed abortion alone was noted in fifth gravida patient. This outcome was somewhat equal in third gravida. Missed abortion was noted more in the first and second gravida patients studied in this study. Fourth gravida patients in this study had equal normal and missed abortion outcome.



Crosstab

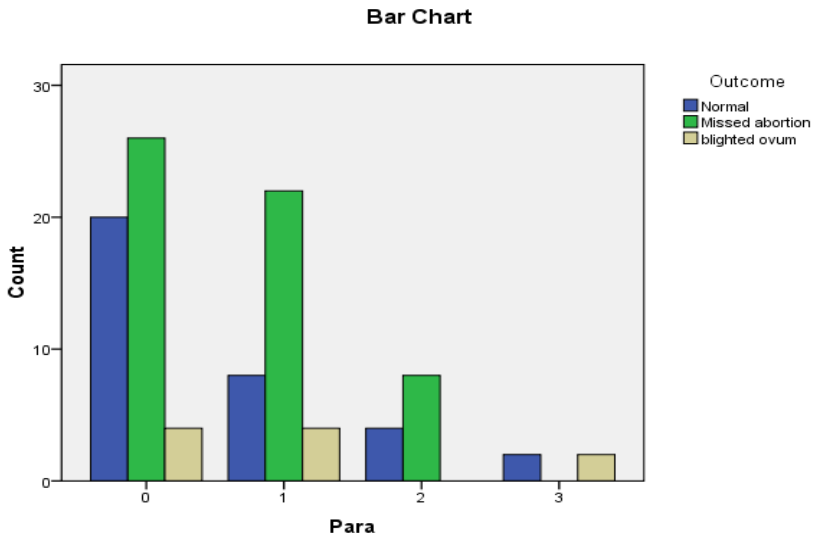
			Outcome			
			Normal	Missed abortion	blighted ovum	Total
Gravida		Count	14	20	4	38
		% within Outcome	41.2%	35.7%	40.0%	38.0%
		% of Total	14.0%	20.0%	4.0%	38.0%
	2	Count	10	22	4	36
		% within Outcome	29.4%	39.3%	40.0%	36.0%
		% of Total	10.0%	22.0%	4.0%	36.0%
	3	Count	6	8	0	14
		% within Outcome	17.6%	14.3%	.0%	14.0%
		% of Total	6.0%	8.0%	.0%	14.0%
	4	Count	4	4	2	10
		% within Outcome	11.8%	7.1%	20.0%	10.0%
		% of Total	4.0%	4.0%	2.0%	10.0%
	5	Count	0	2	0	2
		% within Outcome	.0%	3.6%	.0%	2.0%
		% of Total	.0%	2.0%	.0%	2.0%
	Total	Count	34	56	10	100
		% within Outcome	100.0%	100.0%	100.0%	100.0%
		% of Total	34.0%	56.0%	10.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.661[a]	8	.685
Likelihood Ratio	7.622	8	.471
Linear-by-Linear Association	.005	1	.941
N of Valid Cases	100		

a. 9 cells (60.0%) have expected count less than 5. The minimum expected count is .20.

The following bar diagram suggests the correlation between para and the outcome in this study.



			Outcome			
			Normal	Missed abortion	blighted ovum	Total
Para	0	Count	20	26	4	50
		% within Outcome	58.8%	46.4%	40.0%	50.0%
		% of Total	20.0%	26.0%	4.0%	50.0%
	1	Count	8	22	4	34
		% within Outcome	23.5%	39.3%	40.0%	34.0%
		% of Total	8.0%	22.0%	4.0%	34.0%
	2	Count	4	8	0	12
		% within Outcome	11.8%	14.3%	.0%	12.0%
		% of Total	4.0%	8.0%	.0%	12.0%
	3	Count	2	0	2	4
		% within Outcome	5.9%	.0%	20.0%	4.0%
		% of Total	2.0%	.0%	2.0%	4.0%
	Total	Count	34	56	10	100
		% within Outcome	100.0%	100.0%	100.0%	100.0%
		% of Total	34.0%	56.0%	10.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.921[a]	6	.044
Likelihood Ratio	13.242	6	.039
Linear-by-Linear Association	.864	1	.352
N of Valid Cases	100		

a. 6 cells (50.0%) have expected count less than 5. The minimum expected count is .40.

3. Correlation with consanguineous marriage

The below bar diagram shows the correlation between the outcome of pregnancy with the consanguineous marriage in this study.

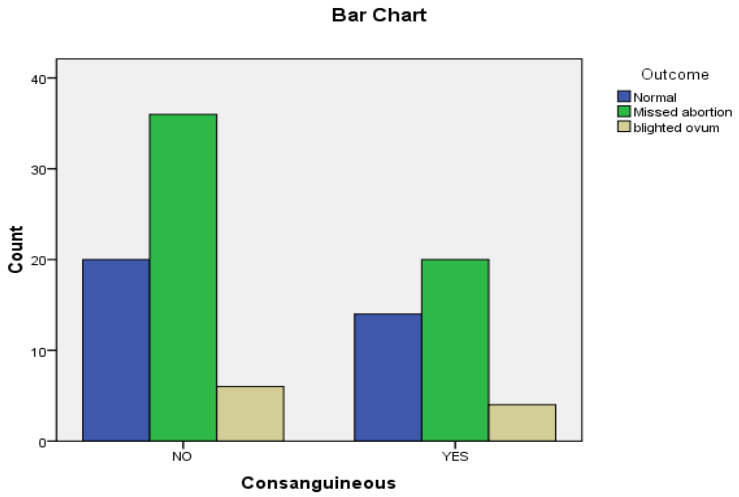
Crosstab

			Outcome			
			Normal	Missed abortion	blighted ovum	Total
Consanguineous	NO	Count	20	36	6	62
		% within Outcome	58.8%	64.3%	60.0%	62.0%
		% of Total	20.0%	36.0%	6.0%	62.0%
	YES	Count	14	20	4	38
		% within Outcome	41.2%	35.7%	40.0%	38.0%
		% of Total	14.0%	20.0%	4.0%	38.0%
	Total	Count	34	56	10	100
		% within Outcome	100.0%	100.0%	100.0%	100.0%
		% of Total	34.0%	56.0%	10.0%	100.0%

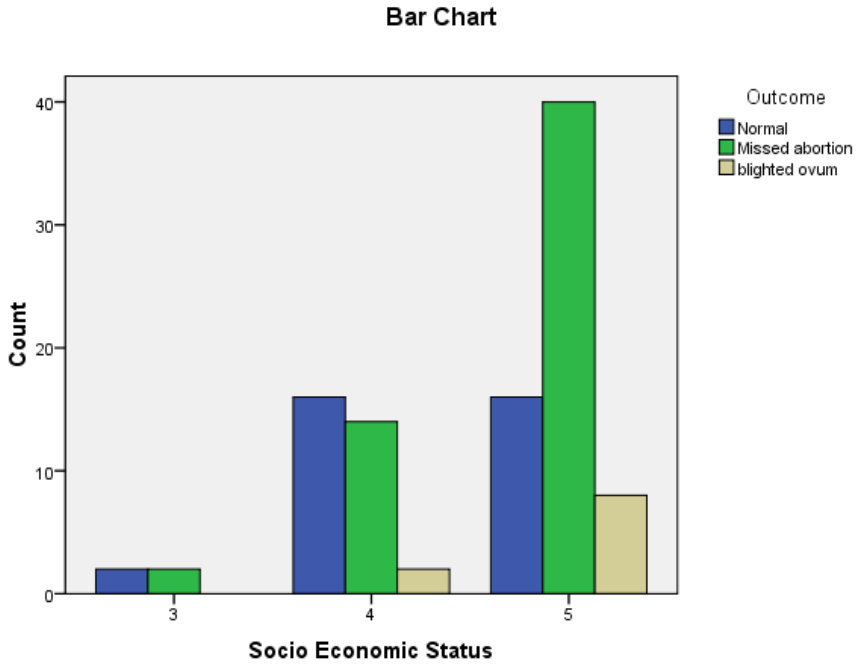
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.287[a]	2	.866
Likelihood Ratio	.286	2	.867
Linear-by-Linear Association	.085	1	.771
N of Valid Cases	100		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.80.



4. Correlation of Socio economic status with outcome



The abortion rates were found to be more among the low socio economic status. Out of 56 patients who belonged low socio economic status 5, 40 patients went in for miscarriage. Thus, it may reflect the effect of low socio economic status and the effect of nutrition in pregnancy outcome.

			Outcome	
			Normal	Missed abortion
Socio Economic Status	3	Count	2	2
		% within Outcome	5.9%	3.6%
		% of Total	2.0%	2.0%
	4	Count	16	14
		% within Outcome	47.1%	25.0%
		% of Total	16.0%	14.0%
	5	Count	16	40
		% within Outcome	47.1%	71.4%
		% of Total	16.0%	40.0%
	Total	Count	34	56
		% within Outcome	100.0%	100.0%
		% of Total	34.0%	56.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.851[a]	4	.144
Likelihood Ratio	7.154	4	.128
Linear-by-Linear Association	5.709	1	.017
N of Valid Cases	100		

a. 4 cells (44.4%) have expected count less than 5. The minimum expected count is .40.

Crosstab

			Outcome	
			blighted ovum	Total
Socio Economic Status	3	Count	0	4
		% within Outcome	.0%	4.0%
		% of Total	.0%	4.0%
	4	Count	2	32
		% within Outcome	20.0%	32.0%
		% of Total	2.0%	32.0%
	5	Count	8	64
		% within Outcome	80.0%	64.0%
		% of Total	8.0%	64.0%
	Total	Count	10	100
		% within Outcome	100.0%	100.0%
		% of Total	10.0%	100.0%

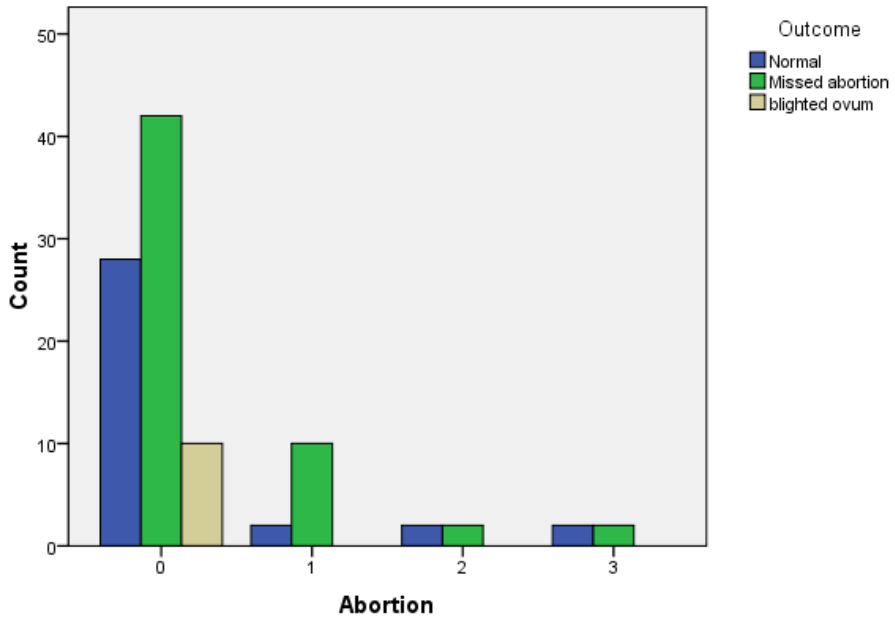
ABORTION OUTCOME

			Outcome			
			Normal	Missed abortion	blighted ovum	Total
Abortion	0	Count	28	42	10	80
		% within Outcome	82.4%	75.0%	100.0%	80.0%
		% of Total	28.0%	42.0%	10.0%	80.0%
	1	Count	2	10	0	12
		% within Outcome	5.9%	17.9%	.0%	12.0%
		% of Total	2.0%	10.0%	.0%	12.0%
	2	Count	2	2	0	4
		% within Outcome	5.9%	3.6%	.0%	4.0%
		% of Total	2.0%	2.0%	.0%	4.0%
	3	Count	2	2	0	4
		% within Outcome	5.9%	3.6%	.0%	4.0%
		% of Total	2.0%	2.0%	.0%	4.0%
	Total	Count	34	56	10	100
		% within Outcome	100.0%	100.0%	100.0%	100.0%
		% of Total	34.0%	56.0%	10.0%	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.014[a]	6	.422
Likelihood Ratio	7.942	6	.242
Linear-by-Linear Association	.899	1	.343
N of Valid Cases	100		

Bar Chart



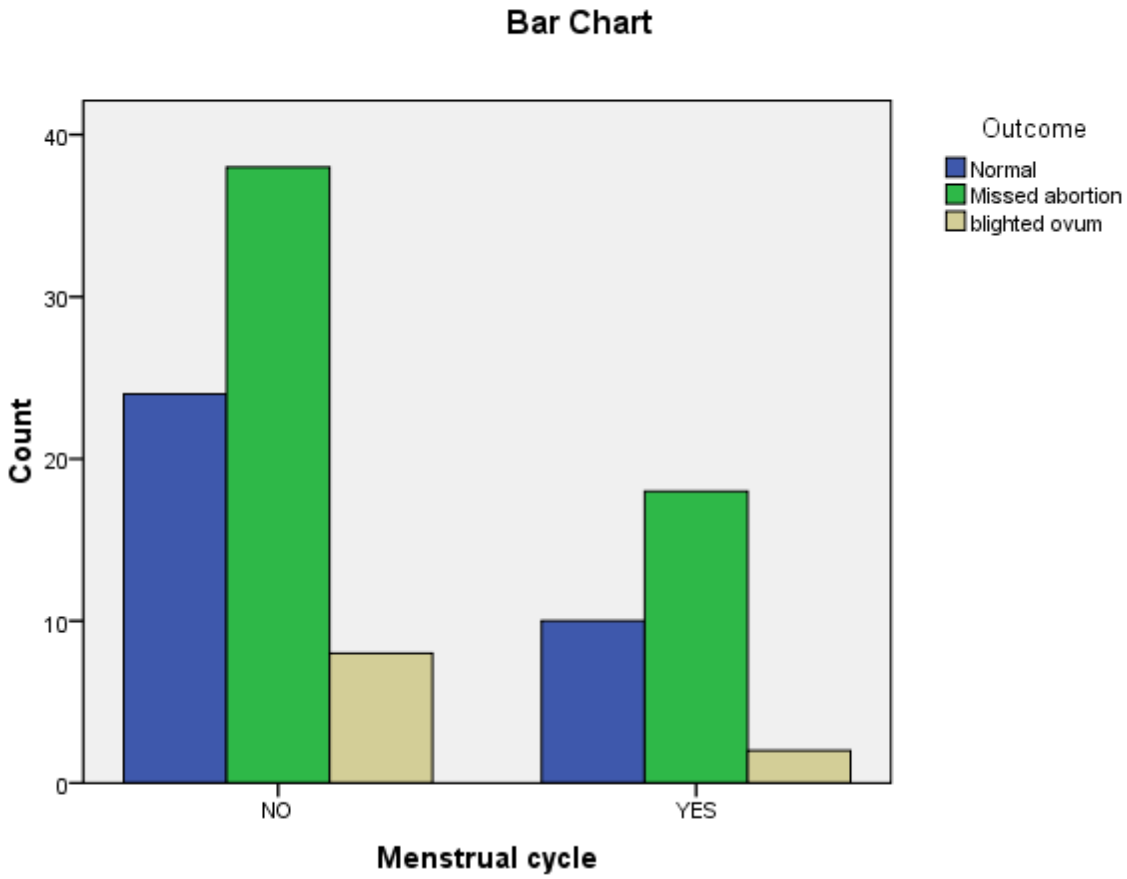
5. Menstrual cycle outcome :

Crosstab

			Outcome			
			Normal	Missed abortion	blighted ovum	Total
Menstrual cycle	NO	Count	24	38	8	70
		% within Outcome	70.6%	67.9%	80.0%	70.0%
		% of Total	24.0%	38.0%	8.0%	70.0%
	YES	Count	10	18	2	30
		% within Outcome	29.4%	32.1%	20.0%	30.0%
		% of Total	10.0%	18.0%	2.0%	30.0%
	Total	Count	34	56	10	100
		% within Outcome	100.0%	100.0%	100.0%	100.0%
		% of Total	34.0%	56.0%	10.0%	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.604[a]	2	.739
Likelihood Ratio	.641	2	.726
Linear-by-Linear Association	.079	1	.779
N of Valid Cases	100		



Among the women with regular cycles (70) 46 ladies had miscarriage among 30 women who had irregular cycles 20 had abortions. Thus this accounts for a minimum correlation of miscarriages with the menstrual cycle.

1. Outcome with respect to Yolk Sac :

In this prospective study, out of 100 patients yolk sac diameter and its characteristics have been studied in detail.

a. Size of yolk sac in this study :

As presented in the following table, in patients with normal outcome the mean diameter of yolk sac has been 4.35 mm. In this normal outcome group, the lower bound diameter that has been recorded ranges from 3.87mm and the upper bound diameter recorded was 4.84mm. In patients with abnormal outcome, which has been divided into missed abortion and blighted ovum group. In patients with abortion as outcome, the mean yolk sac diameter has been ranging from 5.5 mm. In this group the lowest diameter recorded has been around 4.9mm and upper bound diameter recorded has been 6.10mm.

In the next abnormal outcome group, which is blighted ovum the number of patients recorded was around 10. The Mean diameter that has been recorded was around 7.6. So when compared to other groups of both normal and abortion as outcome, the diameter is more. The lowest value that was recorded was around 7.23 and the highest value was around 7.97.

This clearly shows that in both 8-10 weeks and 10-12 weeks group studied the mean yolk sac diameter in groups of abnormal outcome has been on the higher side than normal outcome patients.

The mean standard deviation in abortion group has been 2.248, where as the standard deviation in normal outcome group is in the range of 1.390.

This suggests that the yolk sac diameter has been a crucial factor in finding out the outcome of pregnancy in this first table noted.

Yolk Sac values

					95% Confidence Interval for Mean	
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound
Normal	34	4.35	1.390	.238	3.87	4.84
Missed abortion	56	5.50	2.248	.300	4.90	6.10
blighted ovum	10	7.60	.516	.163	7.23	7.97
Total	100	5.32	2.084	.208	4.91	5.73

			Outcome		
		Normal	Missed abortion	blighted ovum	Total
Yolk Sac Normal	Count	26	2	0	28
	% within Outcome	76.5%	3.6%	.0%	28.0%
	% of Total	26.0%	2.0%	.0%	28.0%
Abnormal	Count	8	54	10	72
	% within Outcome	23.5%	96.4%	100.0%	72.0%
	% of Total	8.0%	54.0%	10.0%	72.0%
Total	Count	34	56	10	100
	% within Outcome	100.0%	100.0%	100.0%	100.0%
	% of Total	34.0%	56.0%	10.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.088[a]	2	.000
Likelihood Ratio	64.234	2	.000
Linear-by-Linear Association	47.735	1	.000
N of Valid Cases	100		

1 cells (16.7%) have expected count less than 5. The minimum expected count is 2.80.

There is a statistical significance with yolk sac diameter and the final outcome as the P value is less than 0.05.

Correlation of data :

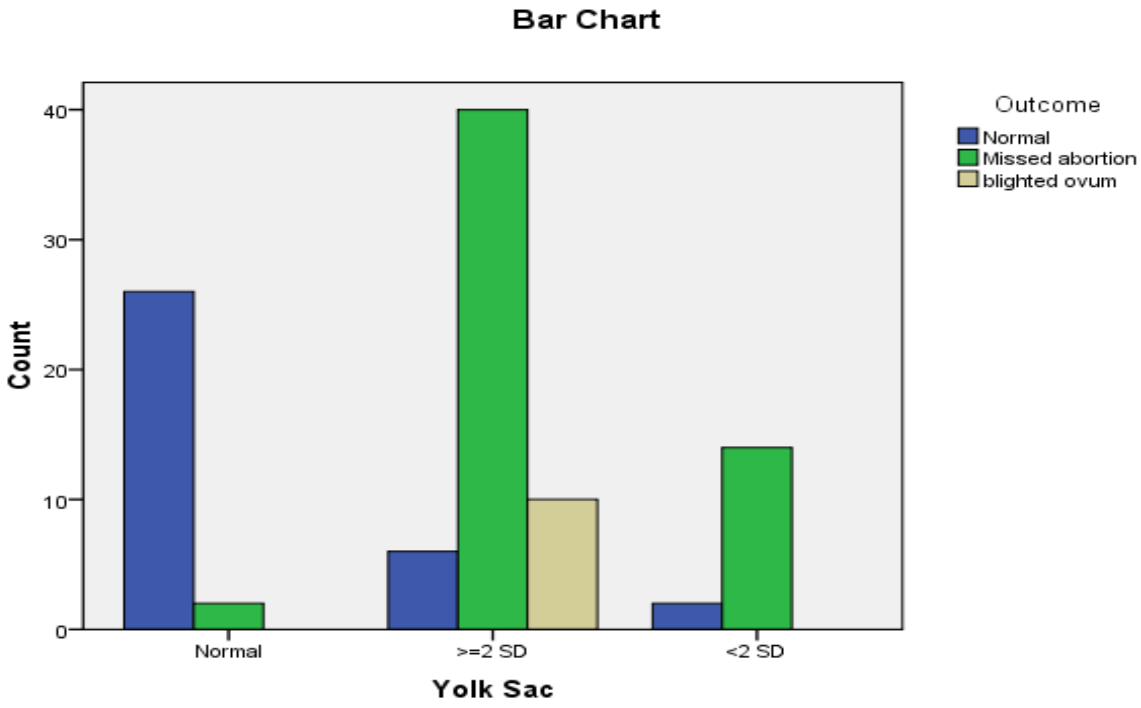
When we take into account the data of patients who were found to have normal characteristics of yolk sac in ultrasound, there has been 76.5% normal progression pregnancy. But in a small percentage of patients, namely 3.6 %, with normal characteristics of yolk sac, there has been abortion noted.

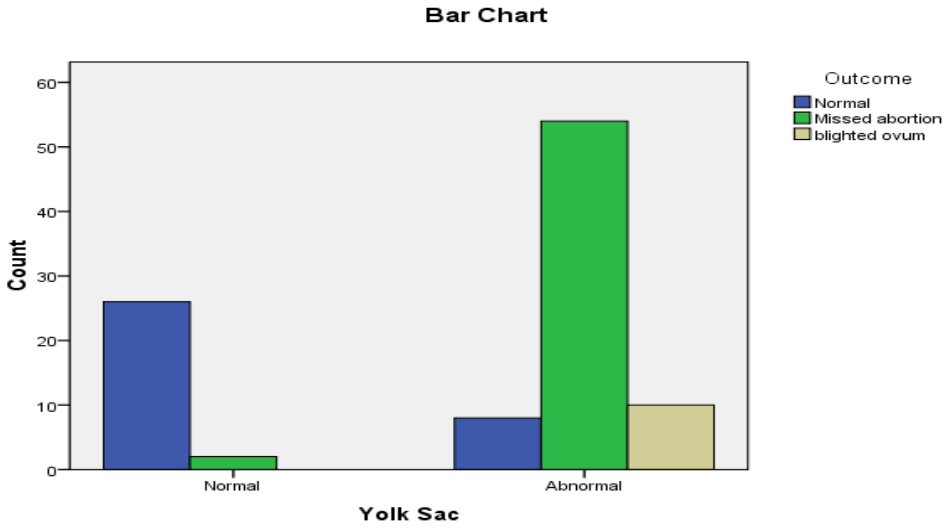
Similarly in case of abnormal yolk sac characteristics, normal progression is noted only in small percentage of patients. But most of the patients, that is around 54 patients had abortion.

In the bar diagram depicted below, if the yolk sac lies within normal range then there is a increase in normal outcome when we follow up the patient. But when there is more than 2 standard deviation in the diameter of yolk sac, then there is more abortion noted.

Similarly when it is less than two standard deviation, then there is missed abortion category more and normal outcome is lesser.

This reverse correlation also suggests that normal diameter and characteristics of yolk sac correlates well with normal outcome of pregnancy. When there is a deviation of size which was on the higher side of diameter of yolk sac then the abortion rates increase drastically.

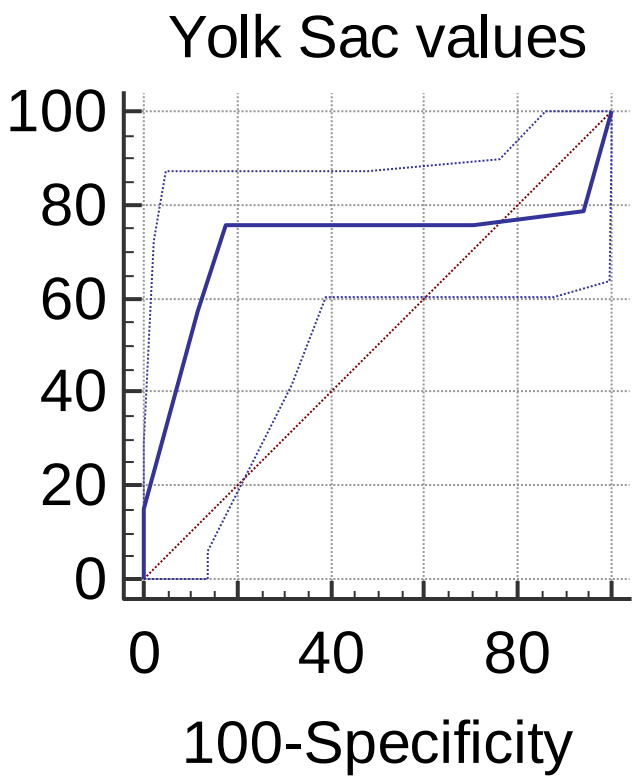

Bar Chart
Outcome
Normal
Missed abortion
blighted ovum
Count
40
30
20
10
0
Normal
>=2 SD
<2 SD
Yolk Sac


Bar Chart
Outcome
Normal
Missed abortion
blighted ovum
Count
60
50
40
30
20
10
0
Normal
Abnormal
Yolk Sac

			Outcome			
			Normal	Missed abortion	blighted ovum	Total
Yolk Sac	Normal	Count	26	2	0	28
		% within Outcome	76.5%	3.6%	.0%	28.0%
		% of Total	26.0%	2.0%	.0%	28.0%
	>=2 SD	Count	6	40	10	56
		% within Outcome	17.6%	71.4%	100.0%	56.0%
		% of Total	6.0%	40.0%	10.0%	56.0%
	<2 SD	Count	2	14	0	16
		% within Outcome	5.9%	25.0%	.0%	16.0%
		% of Total	2.0%	14.0%	.0%	16.0%
	Total	Count	34	56	10	100
		% within Outcome	100.0%	100.0%	100.0%	100.0%
		% of Total	34.0%	56.0%	10.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	64.642[a]	4	.000
Likelihood Ratio	69.708	4	.000
Linear-by-Linear Association	27.133	1	.000
N of Valid Cases	100		



Variable	Yolk_Sac_values Yolk Sac values
Classification variable	Outcome

Sample size	100
Positive group : Outcome = 1	66
Negative group : Outcome = 0	34
Area under the ROC curve (AUC)	0.717
Standard Error[a]	0.0529
95% Confidence interval[b]	0.619 to 0.803
z statistic	4.110
Significance level P (Area=0.5)	<0.0001
Youden index J	0.5811
Associated criterion	>5
Sensitivity	75.76
Specificity	82.35

Criterion	Sensitivity	95% CI	Specificity	95% CI	+LR	-LR
≥2	100.00	94.6 - 100.0	0.00	0.0 - 10.3	1.00	
>2	78.79	67.0 - 87.9	5.88	0.7 - 19.7	0.84	3.61
>3	75.76	63.6 - 85.5	29.41	15.1 - 47.5	1.07	0.82
>5	75.76	63.6 - 85.5	82.35	65.5 - 93.2	4.29	0.29
>6	57.58	44.8 - 69.7	88.24	72.5 - 96.7	4.89	0.48
>7	15.15	7.5 - 26.1	100.00	89.7 - 100.0		0.85
>9	0.00	0.0 - 5.4	100.00	89.7 - 100.0		1.00

Yolk Sac values

					95% Confidence Interval for Mean	
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound
Normal	34	4.35	1.390	.238	3.87	4.84
Missed abortion	56	5.50	2.248	.300	4.90	6.10
blighted ovum	10	7.60	.516	.163	7.23	7.97
Total	100	5.32	2.084	.208	4.91	5.73

Descriptives

Yolk Sac values

	Minimum	Maximum
Normal	2	7
Missed abortion	2	9
blighted ovum	7	8
Total	2	9

ANOVA

Yolk Sac values

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	85.595	2	42.798	12.062	.000
Within Groups	344.165	97	3.548		
Total	429.760	99			

Diagnostic or Screening Test Evaluation

Single Table Analysis

	Abortion	Normal	Total
Abnormal	64	8	72
Normal	2	26	28
	66	34	100

Parameter	Estimate	Lower - Upper 95% CIs	Method
Sensitivity	96.97%	(89.61, 99.17[1])	Wilson Score
Specificity	76.47%	(60, 87.56[1])	Wilson Score
Positive Predictive Value	88.89%	(79.58, 94.26[1])	Wilson Score
Negative Predictive Value	92.86%	(77.35, 98.02[1])	Wilson Score
Diagnostic Accuracy	90%	(82.56, 94.48[1])	Wilson Score

The above analysis help us to come to a conclusion that the measurement of yolk sac diameter has a diagnostic accuracy of 90% in predicting the pregnancy outcome.

DISCUSSION

We have undertaken two groups for study. In the 8- 10 weeks group, totally 52patients were studied. In this group, the normal outcome was seen in 18 patients, Missed abortion was seen in twenty eight patients, Blighted ovum was seen in 6 patients.

In the next group, which ranged from patients in 10 – 12 weeks, forty eight patients were studied. The gross outcome in this group was, normal outcome in sixteen patients, 28 patients had missed abortion, blighted ovum was noted in four patients.So, overall in this study 34 patients had normal outcome, 56 patients had missed abortion, blighted ovum was noted in ten patients.

In this study, less than 20 years of age is 10 patients. 74 patients were between 21- 30 years, which is about 74. Above 31 years of age, 16 patients were studied. Below 20 years of age, 2 had normal outcome, 6 had missed abortion, 2 patients had blighted ovum. In the age 21 to 30 years, 26 had normal outcome, 42 had missed abortion, 6 patients had blighted ovum. Above 31 years, 6 patients had normal outcome, 8 had missed abortion, 2 patients had blighted ovum.

In consanguineous marriage, the yolk sac diameter was slightly higher and it has resulted in increased rates of abortion in this present study. This finding could not be correlated with other studies.

Normal outcome patients had a mean diameter of yolk sac has been 4.35 mm. In patients with abnormal outcome, the mean yolk sac diameter has been ranging from 5.5 mm. In blighted ovum group, the mean diameter that has been

recorded was around 7.6. This clearly shows that in both 8-10 weeks and 10-12 weeks group studied the mean yolk sac diameter in groups of abnormal outcome has been on the higher side than normal outcome patients.

The present prospective observational study clearly demonstrates the fact that visualization of yolk sac and its measurement and morphology is very important for assessing the normal pregnancy outcome.

In previous studies which were carried by Xie YJ et al, non visualization of yolk sac in ultrasound was reported in 0.6% cases. But in this study we were able to record yolk sac diameter and morphology in all the cases studied.In the studies done by Heller R et al, Moradan S et al, Jose L et al, and Shetty AS et al different percentages of non-visualization of the yolk sac were found as 11%, 4.54% , 20.3%, and 4.3%respectively which were much higher than other studies.[19]

Similar findings were reported by Heller R et al, Jose L et al and Sanam Moradan et al. So based on these above mentioned studies, they strongly support the findings of this observational study, that a yolk sac should always be present in case of normal pregnancies.[22]

In Contrast to the present study,Kurtz AB et al and Shetty AS et al depicted the fact that detection of the yolk sac was not an early predictor of pregnancy outcome and they concluded that the absence of the yolk sac was not consistently predictive of a spontaneous abortion. In the study done by Shetty AS et al, only 75%of the cases with absent yolk sac ended in spontaneous abortions.[15]

72% of the cases in this present study showed abnormalities in yolk sac size.Data that was reported by Adija P et al and Küçük T et al, showed that according to them 10% cases and 11.2%cases had abnormal size of the yolk sac. In the same way, in the study by Jose L et al , 5.6% of cases had abnormal size of the yolk sac.[15]

In this current study, about 96% of cases had abortion which were found to have abnormal size of the yolk sac, while in the study that was carried out by Küçük T et al and Adija P et al, abortions due to abnormal yolk sac size occurred in 64.5% and35.71% respectively.[16] These percentages shown above in other studies were much lower than the findings noted in this study. The reason that could be behind these differences in percentages and findings could be the smaller sample size of this present study.

Coming to the dimension of the yolk sac, enlarged yolk sac or larger in size yolk sac (about 2 SD more than normal) was responsible for 71.4% of the abortions in the present study.[8] When compared to other studies, the study which was carried out by Tan S et al and Adija P. et al, abortion occurred in 37.5%and 80% of the cases respectively in which there was enlarged yolk sac was noted.[9]

In the present study, about six cases, even though they had enlarged yolk sac diameter, they progressed beyond 20 weeks of gestation. So around 17% cases may still progress based on this study. This brings none of the cases having enlarged yolk sac size continued beyond 20weeks.

This finding is some what in accordance with the findings of Küçük T et al who had reported that 28.5% of cases of enlarged yolk sac progressed to have a normal outcome.

While in the study that was done by Berdahl DM et al, he reported that 66.25% of the cases, which had enlarged yolk sac still progressed into normal outcome. So the percentage is slightly higher with this study.[10]

According to the study that was done by Malinowski W et al, if we visualize a bigger sized yolk sac, then it is a indicator of poor pregnancy outcome. With concordance with the studies mentioned above, the study conducted by Moradan S et al also showed that yolk sac size was an important factor for prediction of spontaneous abortion. So, these findings are in accordance with the findings of present study.[11]

Cho FN et al has documented the existence of a very large yolk sac, as large with a diameter of 8.1 mm in a normal livepregnancy.[7]So, this finding is also not in accordance with the previous studies. In this study, less than two standard deviations in size of yolk sac is noted in 16 cases. The percentage was around 16 %.In the present study, small size yolk sac was found in 1.4% of cases.

The data given by of Jose L et al was lower , that is about 3.7%.11.11% of the cases of the present study aborted because of small yolk sac size. In the study done by AdijaP et al 1.4% had smaller yolk sac.

In the study by Adija P et al , a smaller yolk sac was related with a high percentage that is about 40% of abortions. In this study, the result showed 14 % of cases had abortion.

SUMMARY

In the present study, we have found out that the yolk sac diameter has a very important role in predicting the pregnancy outcome.

Majority of the women fall under age group of 21 to 30 years which contributed to about 74%. Ten women were under 20 years which contributed to about 10%. 16 women were over the age of 30 years which contributed to about 16%.

In the age group above 30 years, out of 16 patients, ten met with abortions accounting to about 62.5% abortion within that age group. Out of the ten patients under age groups of 20, eight patients had abortion accounting to abortion rate of 80% within that group. Out of the 74 patients in age group of 21 to 30 years, 48 patients went in for abortion and abortion rate was 64% in that group.

About 38 patients fall under the category of primigravida of which 24 patients went in for abortions and the abortion rate was around 63.1% among the primigravida. Among the 35 patients belonging to second gravid 26 patients went in for abortion bringing the abortion rate to 72%. Among the patients belonging to third gravid, 8 patients went in for abortion and rate was found to be 57%. Among the 18 patients greater than fourth order pregnancy, 8 went for abortion bringing the abortion rate to 66%.

In relation to socioeconomic status, 64% patients were in low socioeconomic status V of which 48 patients accounted for abortion. The abortion rate was 75% within that group. Class IV socioeconomic status accounted for 32, among which 16 went for abortions. The rate being 50%.

Out of 62 non consanguineous marriages, 42 patient went for abortions and the abortion rate was found to be 67%.

Out of the 38 consanguineous marriages, 24 went in for abortion accounting to an abortion rate of 63%.

Finally according to the yolk sac parameters , the following output was received and it is detailed below. Among the 28 patients who had normal yolk sac parameters only 2 went in for abortion. So the abortion rate with respect to normal yolk sac parameters was about 7%. Among the 72 patients who had abnormal yolk sac parameters, 64 patients went in for abortion. This brings about a percentage of 88% in patients with abnormal yolk sac parameters.

More specifically, the yolk sac diameter of more than 2 standard deviation, were found among 56 patients, out of which 50 patients ended in abortion. This accounts for the abortion rate of about 89.2%.

Yolk sac diameter of less than two standard deviation were found in 16 patients, out of which 14 ended in abortion resulting in a rate of 87.5%.

From the above study there is a strong correlation between the yolk sac parameters and the successful pregnancy outcome.

Age, parity and the consanguinity and the socioeconomic status play a minor role in predicting the pregnancy outcome whereas when compared to the yolk sac parameters. This yolk sac parameters had a strong correlation with predicting the outcome of pregnancy.

CONCLUSION

The findings of the present study showed that the yolk sac size can be an important predictor for the progression of pregnancy till term and is also useful in predicting the predicting the successful outcome. It has been observed that a larger or a smaller size of the yolk sac reduced the success of pregnancy and may lead to fetal loss in the form of abortion.

So we can see that assessing the yolk sac parameters by an early ultrasonogram, can be useful in predicting the pregnancy which may end up in fetal loss. So that these pregnancies can be followed up at closer intervals by ultrasonogram to detect the fetal loss at the earliest.

However, further research with a well designed study group with a bigger population is necessary to study the role of yolk sac diameter in predicting the pregnancy outcome in first trimester and it helps in detecting the at risk pregnancies and may avoid unnecessary delay in detecting early pregnancy loss.

Thus by assessing the yolk sac parameters helps in predicting the pregnancy loss at the earliest and thus the patients may be in close follow up and may prevent inadvertent bleeding episodes which may be detrimental to the mother.

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PROFORMA

NAME: IP No.

1. Age of the mother :
2. Residence : Urban/rural
3. Educational status : literate/illiterate
4. Occupation : Housewife/working
5. Socioeconomic status :
6. Family : Joint/nuclear
7. Menstrual problems since menarche : yes /no
8. Age at the time of marriage : a)< 18 yrs b) 18-30 yrs
   c)31-40 yrs d)>40 yrs
9. Bleeding disorders in family : yes /no
10. Gravida : primi /multi
11. Number of living children : <2 /> 2
12. Age at first pregnancy : a) <18 yrs b)18 -30 yrs
    c) 31-40 yrs d) >40 yrs
13. Interpregnancy interval : < 3 yrs /> 3 yrs
14. History of medical illness : anaemia / chronic hypertension
    / heart disease /thyroid disorders
15. Contraceptive if used prior to this pregnancy : yes/no
16. Booked for the first pregnancy : yes /no

17. History of any renal disease : yes / no

18. Blood grouping : Rh +ve / Rh -ve

19. History of liver disorders : yes /no

20. History of recent surgery : yes /no

21. History of fever during this pregnancy : yes /no

22. History of hyperemesis gravidorum : yes /no

23. Previous history of miscarriages : yes /no

24. Number of pregnancy loses : < 2 /> 2

25. History of any structural abnormalities of

26. uterus and cervix detected prior : yes /no

27. History of consanguinity : yes /no

ABBREVIATION

USG	:	ULTRASOUND
CRL	:	CROWN RUMP LENGTH
MSD	:	MEAN SAC DIAMETER

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI 600 003

EC Reg.No.ECR/270/Inst./TN/2013
Telephone No.044 25305301
Fax: 011 25363970

CERTIFICATE OF APPROVAL

To
Dr.Selvi.R
I Year Post Graduate in MS O & G
IOG/MMC
Chennai

Dear Dr.Selvi.R,

The Institutional Ethics Committee has considered your request and approved your study titled **"PROSPECTIVE STUDY IN PREDICTING PREGNANCY OUTCOME USING YOLK SAC PARAMETERS IN FIRST TRIMESTER " - NO.26112017**

The following members of Ethics Committee were present in the meeting hold on **07.11.2017** conducted at Madras Medical College, Chennai 3

1. Prof.P.V.Jayashankar	:Chairperson
2. Prof.R.Narayana Babu,MD.,DCH., Dean,MMC,Ch-3	: Deputy Chairperson
3. Prof.Sudha Seshayyan,MD., Vice Principal,MMC,Ch-3	: Member Secretary
4. Prof.N.Gopalakrishnan,MD,Director,Inst.of Nephrology,MMC,Ch	: Member
5. Prof.S.Mayilvahanan,MD,Director,Inst. of Int.Med,MMC, Ch-3	: Member
6. Prof.A.Pandiya Raj,Director, Inst. of Gen.Surgery,MMC	: Member
7. Prof.Shanthy Gunasingh, Director, Inst.of Social Obstetrics,KGH	: Member
8. Prof.Rema Chandramohan,Prof.of Paediatrics,ICH,Chennai	: Member
9. Prof. Susila, Director, Inst. of Pharmacology,MMC,Ch-3	: Member
10.Prof.K.Ramadevi,MD., Director, Inst. of Bio-Chemistry,MMC,Ch-3	: Member
11.Prof.Bharathi Vidya Jayanthi,Director, Inst. of Pathology,MMC,Ch-3	: Member
12.Thiru S.Govindasamy, BA.,BL,High Court,Chennai	: Lawyer
13.Tmt.Arnold Saulina, MA.,MSW.,	:Social Scientist
14.Thiru K.Ranjith, Ch- 91	: Lay Person

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary – Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

கர்பிணிக்கான ஆலோசனை படிவம்

1. நாங்கள் ஆய்வு ஒன்றை நடத்தவுள்ளோம் .

2 . அதில் ஸ்கேன் கருவி கொண்டு அளக்கப்படும் யோக் சாக் எனப்படும் கருவின் ஒரு பகுதியின் அளவு வைத்து கருவின் வளர்ச்சி மற்றும் முன்னேற்றம் எவ்வாறு இருக்கும், என்று முடிவு செய்கிறோம்.

3.எந்த ஆய்வில் முதல் மூன்று மாதத்திற்கு உட்பட்ட கர்பிணிகளுக்கு ஸ்கேன் மூலம் யோக் சாக்கை அளந்து அதன் அமைப்பையும் அளவுகளையும் வைத்து அக்கருவின் வளர்ச்சி கண்காணிக்கப்படுகிறது .

4.யோக் சாக்கின் உட்புறஅளவு மற்றும் வடிவத்தை கொண்டு கருவின் நிலைக்கும் தன்மைஎப்படியிருக்கும் என்று இருவதாவது வாரம் வரை கண்காணிக்கப்படுகிறது .

5.யோக் சாக்கின் உட்புறஅளவு ஐந்து மில்லிமீட்டருக்கு மேல் இருக்கும் தருவாயில் அக்கருவின் நிலைக்கும் தன்மை குறைகிறதா என்று கண்காணிக்கப்படுகிறது .

6. அதேபோல் யோக் சாக்கின் வடிவம் வட்டமாக இல்லாத தருவாயில் அக்கருவின் நிலைக்கும் தன்மை குறைகிறதா என்று கண்காணிக்கப்படுகிறது

.7. இவ்வாறு ஆய்வு மேற்கொள்ளும் போது இந்த கர்பிணிகளுக்கு கிடைக்கும் சிகிச்சை எவ்விதத்திலும் பாதிக்காது என்று தெரிவித்துக்கொள்கிறோம்

8 .இந்த ஆய்வின் நிகழ்வுகள் பதிப்பில் வரும் பட்சத்தில் கர்ப்பிணிகளின் பெயர் மற்றும் தனிப்பட்ட விபரங்கள் எதுவும் வெளியிடப்படாது என்று தெரிவித்து கொள்கிறோம் .

9 .கர்ப்பிணிகளின் தனியுரிமை இந்த ஆய்வு முழுவதும் காப்பாற்றப்படும் என தெரிவித்துக்கொள்கிரோம் .

10 .இந்த ஆய்வில் பங்கேற்பது முழுவதும் கர்ப்பிணிகளின் தன்னார்வத்தின் அடிப்படையிலே இருக்கும் .இதில் பங்கேற்பது பற்றியும் விலகுவது பற்றியும் கர்ப்பிணிகளே முடிவெடுத்துக்கொள்ளலாம் .இந்த முடிவு அவர்களுக்கு கிடைக்கும் அடிப்படை நன்மையை எவ்விதத்திலும் பாதிக்காது .

11.இந்த ஆய்வின் முடிவுகள் கர்ப்பிணிகளுக்கு இறுதியில் அறிவிக்கப்படும் .

12 .அல்லது ஏதேனும் அசாதாரண முடிவுகள் இருப்பின் இந்த ஆய்வின் போதே ,கர்ப்பகால சிகிச்சைக்கு ஏதுவாய் அறிவிக்கப்படும் .

இந்த கண்காணிக்கப்பட்ட ஆய்விற்கு தாங்களும் பதிவு செய்து தங்களது முழுஒத்துழைப்பை நல்குமாறு தங்களை அன்புடன் கேட்டுகொள்கிறேன்.

நோயாளிகள் ஒப்புதல்

இதற்க்கான பரிசோதனை மற்றும் நடத்தப்படும் பற்றி முழுமையாக மருத்துவர் விளக்கினார். நான் இந்த ஆய்வில் பங்கெடுக்க முழு மனதுடன் சம்மதம் தெரிவிகின்றேன் .

ஆய்வாளரின் கையொப்பம் கர்ப்பிணியின் கையொப்பம்

PATIENT CONSENT FORM

Research Center: Government Maternity Hospital, Egmore, Chennai

Name of the Participant :

Signature of the Participant:

Thumb impression ( )

The details of the above study are explained to me.

1. I had asked about the study and my doubts are cleared and I Got the opportunity to get the explanations regarding the study ( )
2. I am involved in this study voluntarily. There is no compulsion.
   I can voluntarily discontinue the study at any stage without legal issues ( )
3. This study is based on further research . My doctor who participates in this study does not want my permission to see medical reports. I also know even if I am leaving the study, I know that this applies. I allow the doctor to publish. The results of this study. ( )
4. I agree to cooperate in this study as told by the investigators ( )
5. I agree the investigations like blood , urine, ultrasound abdomen. ( )

Signature of the Investigator and Date

INFORMATION SHEET

1. We are conducting a study to predict the pregnancy outcome by measuring the yolk sac parameters.
2. We are selecting antenatal women according to the need of the study. we wish participate in this study
3. In this study we are measuring the diameter and the shape the yolk sac and predicting the outcome of the pregnancy accordingly.
4. The yolk sac is said to be uniformly round with an anechogenic centre. The normal diameter of the yolk sac is 2 -5 mm .
5. If the diameter exceeds 5 mm or the shape is irregular then it is associated with abnormal outcome ,so those patients are followed up till 20 weeks of gestation.
6. Your participation in this study will not affect your AN care or any treatment if needed.
7. The privacy of the patients in the research will be maintained throughout the study.
8. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared
9. Taking part in this study is voluntary . You are free to decide whether to participate in this study or withdraw at any time .Your decision will not result in any loss of benefits to which you are otherwise entitled.
10. The results of the study may be intimated to you at the end of the study period or during the study, if anything is found abnormal which may aid in the management or treatment.

SIGNATURE OF THE PARTICIPANT SIGNATURE OF THE INVESTIGATOR

DATE

கர்பிணிக்கான ஒப்புதல் படிவம்

ஆராய்ச்சி நிலையம்: அரசு மகப்பேறு மருத்துவமனை, எழும்பூர் , சென்னை

பங்குபெறுபவரின் பெயர்:

பங்குபெறுபவரின் கையொப்பம்:

பங்குபெறுபவர் இதனை ( ) குறிக்கவும்

மேலே குறிப்பிட்டுள்ள ஆய்வின் விவரங்கள் எனக்கு விளக்கப்பட்டது. என்னுடைய சந்தேகங்களை கேட்கவும், அதற்கான தகுந்த விளக்கங்களை பெறவும் வாய்ப்பளிக்கப்பட்டது . ☐

நான் இந்த ஆய்வில் தன்னிச்சையாகத்தான் பங்குபெருகிரேன். .எந்த காரணத்தினாலோ எந்த சட்டசிக்கல்களுக்கும் உட்படாமல் நான் இந்த ஆய்வில் இருந்து விலகிக்கொள்ளலாம் என்று அறிந்துகொண்டேன். ☐

இந்த ஆய்வு சம்பந்தமாகவோ, இதை சார்ந்த மேலும் ஆய்வு மேற் கொள்ளும்போதும் இந்த ஆய்வில் பங்குபெறும் மருத்துவர் என்னுடைய மருத்துவ அறிக்கைகளை பார்ப்பதற்கு என் அனுமதிதேவையில்லை என அறிந்து கொள்கிறேன். .நான் ஆய்வில் இருந்து விலகிக்கிகொண்டாலும் இது பொருந்தும் என அறிந்தேன். ☐

இந்த ஆய்வின் மூலம் கிடைக்கும் தகவல்களையும் , பரிசோதனை முடிவுகளையும், மற்றும் சிகிச்சைதொடர்பான தகவல்களையும் மருத்துவர் மேற்கொள்ளும் ஆய்வில் பயன்படுத்திக்கொள்ளவும் அதை பிரசுரிக்கவும் என் முழுமனதுடன் சம்மதிக்கிறேன். ☐

இந்த ஆய்வில் பங்கு கொள்ள ஒப்புக்கொள்கிறேன். எனக்கு கொடுக்கப்பட

அறிவுரைகளின்படி நடந்துகொள்வதுடன் இந்த ஆய்வைமேற்கொள்ளும் மருத்துவஅணிக்கு உண்மையுடன் இருப்பேன் என்றும் உறுதி அளிகின்றேன். என் உடல்நலம் பாதிக்கப்பட்டாலோஅல்லதுஎதிர்பாராத, வழக்திர்க்குமாறன நோய்க்குறி தென்பட்டாலோ உடனே அதை மருத்துவஅணிக்கு தெருவிப்பேன் என உறுதிஅளிக்கிறேன்.

இந்தஆய்வில் எனக்கு ரத்தம், சிறுநீர், , ஸ்கேன், உட்பட அனைத்து பரிசோதனைகளையும் செய்துகொள்ள நான் முழு மனதுடன்சம்மதிக்கிறேன்.

பங்கேற்பவரின்கையொப்பம்.....இடம்.....தேதி.....

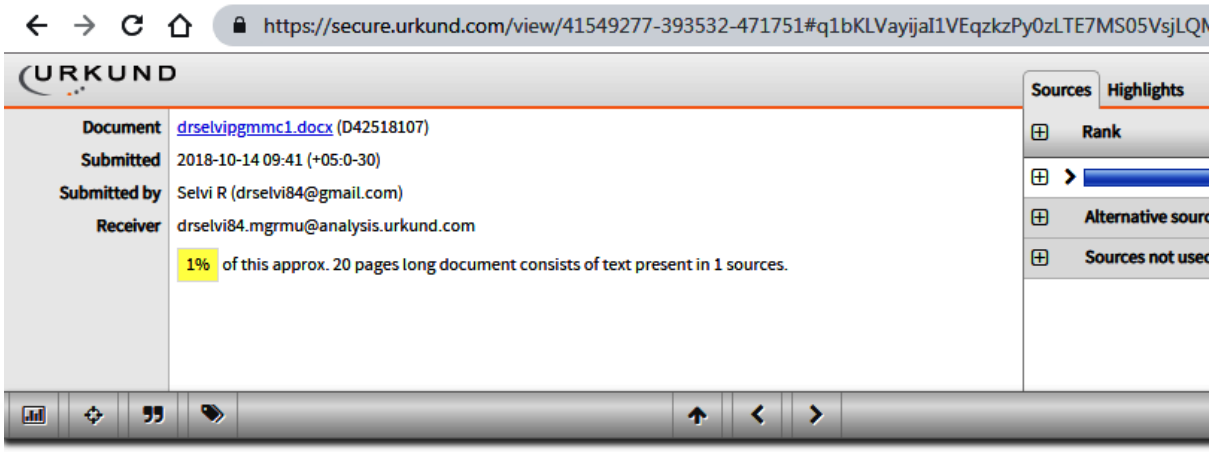
கட்டைவிரல்ரேகை.....

பங்கேற்பவரின்பெயர்மற்றும்விலாசம் .....

.....

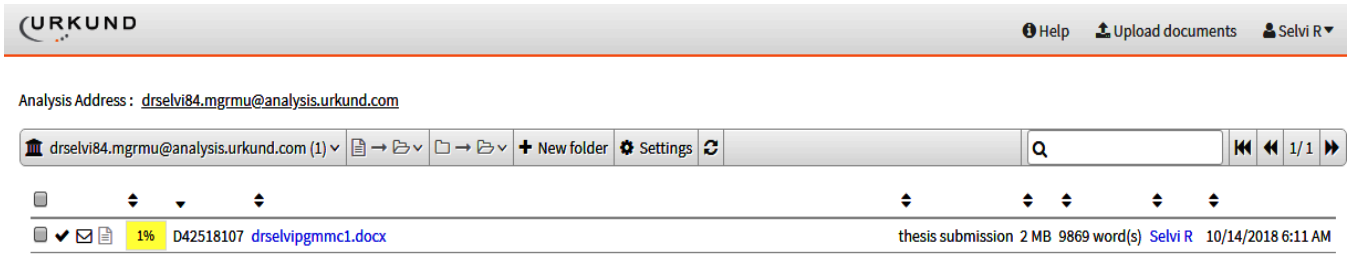
ஆய்வாளரின்கையொப்பம்.....இடம்.....தேதி.....

ஆய்வாளரின்பெயர் .....



INTRODUCTION Yolk sac is the first ultrasonographically visible extra embryonic structure within the gestational sac. Between Human embryo and mother, yolk sac is the primary route of exchange before circulation of placenta is established. Yolk sac reaches its highest level of functional activity in 4th to 7th week of embryonic development. It serves as a hematopoietic, secretory, metabolic, immunogenic, excretory function. Primary Yolk sac forms at approximately twenty four days of menstrual age. When the extraembryonic coelom forms, primary yolk sac is pinched off and the secondary yolk sac is formed at 27 to 28 days of menstrual age. This as mentioned above becomes the first embryonic structure to be visualized in gestational sac sonographically. Gross changes in its morphology, indicate significant dysfunction of this transport system between maternal and fetal parts. This also may indicate impending embryonic demise. In the early stage of pregnancy, evaluation of embryo and gestational sac by ultrasound is very important. Accurate differentiation between normal pregnancy and loss of pregnancy in early gestation is the most important clinical challenge.. The estimated implanted pregnancies resulting in spontaneous abortion during 1st trimester is around thirty to forty percent. Critical landmark to identify a true gestational sac is the Yolk sac. Ultrasound shows Yolk sac as a round structure with anechoic center bordered by a regular well defined echogenic rim. Yolk sac diameter is usually 2- 5 mm and it increases in size till 10th week. In Early pregnancy, threatened and spontaneous abortions is the most common complication. As per some studies, enlarged or small yolk sac predicts poor pregnancy outcome. Whereas other studies, they conclude normal outcome. Thus, the purpose of this study is to evaluate the yolk sac size and correlate with outcome of pregnancy.

AIMS AND OBJECTIVES To study and evaluate the inner diameter and the shape of yolk sac in first trimester using transabdominal ultrasonography and to correlate it with pregnancy outcome.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PLAGIARSM CERTIFICATE

This is to certify that this dissertation work titled **"Prospective study in predicting Pregnancy outcome using Yolk Sac parameters in first Trimester"** of the candidate **Dr. Selvi. R** with **Reg. No.221716015** for the award of M.S in the branch of **OBSTETRICS AND GYNAECOLOGY**. I personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion pages and the result shows one percentage of plagiarism in the dissertation (D42518107)

Signature and Seal of the Guide

Prof. DR. SHOBHA, M.D., D.G.O.
Director
Institute of Obstetrics and Gynecology,
Madras Medical College
Chennai

s.no	Name	GROUP	Age	age group	Socio Econ	Gravida	Para	Live	Abortion	Consanguir	Menstrual	No.of years	GA (days)	CRL (mm)	G Sac (cm)	Yolk Sac va	Yolk Sac	Yolk Sac	Outcome	Outcome
1	Meena	1	18	1	5	1	0	0	0	0	0	1	67	28	40	4	0	0	0	0
2	Keerthana	2	18	1	5	1	0	0	0	0	0	1	77	-	4.5	7	1	1	1	2
3	Lakshmi	1	18	1	5	1	0	0	0	0	0	1	67	28	40	4	0	0	0	0
4	Kavitha	2	18	1	5	1	0	0	0	0	0	1	77	-	4.5	7	1	1	1	2
5	Karthika	1	20	1	5	1	0	0	0	1	1	1	70	35	4.2	7	1	1	1	1
6	Suganya	1	20	1	5	1	0	0	0	0	0	1	67	29	3.8	7	1	1	1	1
7	Saranya	1	20	1	5	1	0	0	0	0	1	1	70	35	4.2	7	1	1	1	1
8	Krishnaven	1	20	1	5	1	0	0	0	1	1	1	70	35	4.2	7	1	1	1	1
9	Suhasini	1	20	1	5	1	0	0	0	0	0	1	67	29	3.8	7	1	1	1	1
10	Sarika	1	20	1	5	1	0	0	0	0	1	1	70	35	4.2	7	1	1	1	1
11	Sangeetha	1	21	2	4	2	1	1	0	0	0	3	65	-	3	8	1	1	1	2
12	Jessy	2	21	2	5	1	0	0	0	0	0	1	84	56	6	8	1	1	1	1
13	Sunandha	1	21	2	4	2	1	1	0	0	0	3	65	-	3	8	1	1	1	2
14	Joy	2	21	2	5	1	0	0	0	0	0	1	84	56	6	8	1	1	1	1
15	Bakiyam	2	23	2	5	3	2	0	0	1	0	4	78	48	5.4	6	1	1	1	1
16	Barathi	2	23	2	5	3	2	0	0	1	0	4	78	48	5.4	6	1	1	1	1
17	Nisha	1	24	2	5	2	0	0	1	0	0	4	82	58	6	3	0	0	0	0
18	Jayapriya	1	24	2	5	2	1	1	0	0	1	3	70		4	8	1	1	1	2
19	Amutha	2	24	2	4	3	2	2	0	0	1	4	84	58	6	6	1	1	1	1
20	Hemalatha	2	24	2	5	2	0	0	1	1		5	84	56	5.9	7	1	1	1	1
21	Nishanthi	1	24	2	5	2	0	0	1	0	0	4	82	58	6	3	0	0	0	0
22	Jayalakshm	1	24	2	5	2	1	1	0	0	1	3	70		4	8	1	1	1	2
23	Alina	2	24	2	4	3	2	2	0	0	1	4	84	58	6	6	1	1	1	1
24	Hemamalir	2	24	2	5	2	0	0	1	1		5	84	56	5.9	7	1	1	1	1
25	Kalpana	1	25	2	4	1	0	0	0	0	0	2	64	26	3.5	4	0	0	0	0
26	Priya	1	25	2	5	1	0	0	0	0	1	2	58	15	3	6	1	1	1	1
27	Uma Mahe	1	25	2	4	1	0	0	0	1	0	1	65	26	3.8	7	1	1	1	1
28	Kayalvizhi	1	25	2	4	4	1	1	2	0	0	5	64	2	3.8	7	1	1	1	1
29	Ranjitha	2	25	2	5	5	1	1	3	0	0	5	83	56	6	2	1	2	1	1
30	Kamala	1	25	2	4	1	0	0	0	0	0	2	64	26	3.5	4	0	0	0	0
31	Preetha	1	25	2	5	1	0	0	0	0	1	2	58	15	3	6	1	1	1	1
32	Gowri	1	25	2	4	1	0	0	0	1	0	1	65	26	3.8	7	1	1	1	1
33	Sushila	1	25	2	4	4	1	1	2	0	0	5	64	2	3.8	7	1	1	1	1
34	Ranjitha	2	25	2	5	5	1	1	3	0	0	5	83	56	6	2	1	2	1	1
35	Indu	1	26	2	3	1	0	0	0	1	0	1	60	15	3.1	3	0	0	0	0
36	Manimega	2	26	2	4	2	1	1	0	0	1	4	80	52	5.8	4	0	0	0	0
37	Chandra	1	26	2	5	2	1	1		0	0	4	63	24	36	2	1	2	1	1
38	Jansi	1	26	2	5	3	2	2	0	1	0	5	66	26	3.9	2	1	2	1	1
39	Ilakiya	1	26	2	3	1	0	0	0	1	0	1	60	15	3.1	3	0	0	0	0
40	Madhavi	2	26	2	4	2	1	1	0	0	1	4	80	52	5.8	4	0	0	0	0
41	Chandra	1	26	2	5	2	1	1		0	0	4	63	24	36	2	1	2	1	1
42	Jansi	1	26	2	5	3	2	2	0	1	0	5	66	26	3.9	2	1	2	1	1
43	Mohanapri	2	27	2	5	1	0	0	0	1	1	1	80	54	5.8	7	1	1	0	0
44	Saritha	1	27	2	5	2	1	1	0	0	0	5	70	36	4.1	6	1	1	1	1
45	Gayathri	2	27	2	5	4	3	3	0	1	0	5	77	-	3	7	1	1	1	2
46	Maheswari	2	27	2	5	1	0	0	0	1	1	1	80	54	5.8	7	1	1	0	0
47	Sripriya	1	27	2	5	2	1	1	0	0	0	5	70	36	4.1	6	1	1	1	1
48	Gayathri	2	27	2	5	4	3	3	0	1	0	5	77	-	3	7	1	1	1	2

49	Bhuvana	2	28	2	5	1	0	0	0	0	1	2	77	46	4.5	5	0	0	0	0
50	Mangalam	2	28	2	4	2	1	1	0	1	0	4	77	49	5.5	5	0	0	0	0
51	Deepa	2	28	2	5	1	0	0	0	1	0	1	79	47	5.3	7	1	1	1	1
52	Vidhya	2	28	2	4	2	1	1	0	0	1	4	84	56	6	2	1	2	1	1
53	Savitha	2	28	2	5	1	0	0	0	0	1	2	77	46	4.5	5	0	0	0	0
54	Malini	2	28	2	4	2	1	1	0	1	0	4	77	49	5.5	5	0	0	0	0
55	Devipriya	2	28	2	5	1	0	0	0	1	0	1	79	47	5.3	7	1	1	1	1
56	Vidhya	2	28	2	4	2	1	1	0	0	1	4	84	56	6	2	1	2	1	1
57	Flora	1	29	2	5	4	2	1	1	1	1	6	69	36	4	6	1	1	1	1
58	Chellamma	2	29	2	4	1	0	0	0	0	0	5	79	48	5.2	7	1	1	1	1
59	Thirana	2	29	2	5	2	0	0	1	0	0	6	77	45	4.5	7	1	1	1	1
60	Yamunavat	2	29	2	5	2	1	1	0	0	1	3	77	46	4.6	2	1	2	1	1
61	Angita	1	29	2	5	4	2	1	1	1	1	6	69	36	4	6	1	1	1	1
62	Chellathai	2	29	2	4	1	0	0	0	0	0	5	79	48	5.2	7	1	1	1	1
63	Thirana	2	29	2	5	2	0	0	1	0	0	6	77	45	4.5	7	1	1	1	1
64	Meher	2	29	2	5	2	1	1	0	0	1	3	77	46	4.6	2	1	2	1	1
65	Shazia	1	30	2	4	2	1	1	0	1	1	5	70	33	4.1	6	1	1	0	0
66	Valli	1	30	2	4	1	0	0	0	0	0	5	70	34	4.4	4	0	0	0	0
67	Yogapriya	1	30	2	5	3	2	2	0	1	0	7	66	27	3.8	5	0	0	0	0
68	Aishwariya	1	30	2	4	3	0	0	2	0	0	6	70	36	4.1	3	0	0	0	0
69	Puthiyanila	2	30	2	4	4	3	3	0	1	1	6	84	56	6	2	1	2	0	0
70	Yogeswari	2	30	2	5	1	0	0	0	1	0	3	74	43	5.2	5	0	0	0	0
71	Sajitha	1	30	2	5	2	1	1	0	1	0	6	63	27	3.4	7	1	1	1	1
72	Fathima	2	30	2	5	1	0	0	0	0	1	7	82	54	5.8	7	1	1	1	1
73	Padma	2	30	2	4	2	1	1	0	1	0	5	84	58	6	6	1	1	1	1
74	Malar	2	30	2	5	3	1	1	1	0	1	6	77	48	5.4	9	1	1	1	1
75	Rani	1	30	2	4	2	1	1	0	1	1	5	70	33	4.1	6	1	1	0	0
76	Kanmani	1	30	2	4	1	0	0	0	0	0	5	70	34	4.4	4	0	0	0	0
77	Umarani	1	30	2	5	3	2	2	0	1	0	7	66	27	3.8	5	0	0	0	0
78	Priyadarshi	1	30	2	4	3	0	0	2	0	0	6	70	36	4.1	3	0	0	0	0
79	Tara	2	30	2	4	4	3	3	0	1	1	6	84	56	6	2	1	2	0	0
80	Ramya	2	30	2	5	1	0	0	0	1	0	3	74	43	5.2	5	0	0	0	0
81	Ayesha	1	30	2	5	2	1	1	0	1	0	6	63	27	3.4	7	1	1	1	1
82	Ashwini	2	30	2	5	1	0	0	0	0	1	7	82	54	5.8	7	1	1	1	1
83	Prabhavath	2	30	2	4	2	1	1	0	1	0	5	84	58	6	6	1	1	1	1
84	Gunavathi	2	30	2	5	3	1	1	1	0	1	6	77	48	5.4	9	1	1	1	1
85	Anjalai	2	31	3	4	2	1	1	0	0	0	6	83	54	5.8	4	0	0	0	0
86	Tamilarasi	1	31	3	5	1	0	0	0	1	0	3	52	-	2.3	8	1	1	1	2
87	Varsha	1	31	3	3	2	1	1	0	0	0	6	56	16	3.2	7	1	1	1	1
88	Tamilselvi	2	31	3	4	2	1	1	0	0	0	6	83	54	5.8	4	0	0	0	0
89	Tamilazhag	1	31	3	5	1	0	0	0	1	0	3	52	-	2.3	8	1	1	1	2
90	Naveena	1	31	3	3	2	1	1	0	0	0	6	56	16	3.2	7	1	1	1	1
91	Bavani	1	32	3	5	3	2	2	0	0	0	6	66	28	3.8	7	1	1	0	0
92	Malathi	2	32	3	5	1	0	0	0	0	0	4	79	48	5.1	3	0	0	1	1
93	Sreelatha	1	32	3	5	3	2	2	0	0	0	6	66	28	3.8	7	1	1	0	0
94	Shameem	2	32	3	5	1	0	0	0	0	0	4	79	48	5.1	3	0	0	1	1
95	Nivetha	2	34	3	5	4	0	0	3	0	0	8	84	55	5.9	3	0	0	0	0
96	Lavanya	2	34	3	5	4	0	0	3	0	0	8	84	55	5.9	3	0	0	0	0
97	Tanu	1	35	3	4	2	1	1	0	0	0	8	71	37	4.1	2	1	2	1	1

98	Priscilla	1	35	3	4	2	1	1	0	0	0	8	71	37	4.1	2	1	2	1	1
99	Dharshini	1	36	3	5	2	0	0	1	1	0	4	70	37	4.2	2	1	2	1	1
100	Vinodhini	1	36	3	5	2	0	0	1	1	0	4	70	37	4.2	2	1	2	1	1